



E. C. Roodman

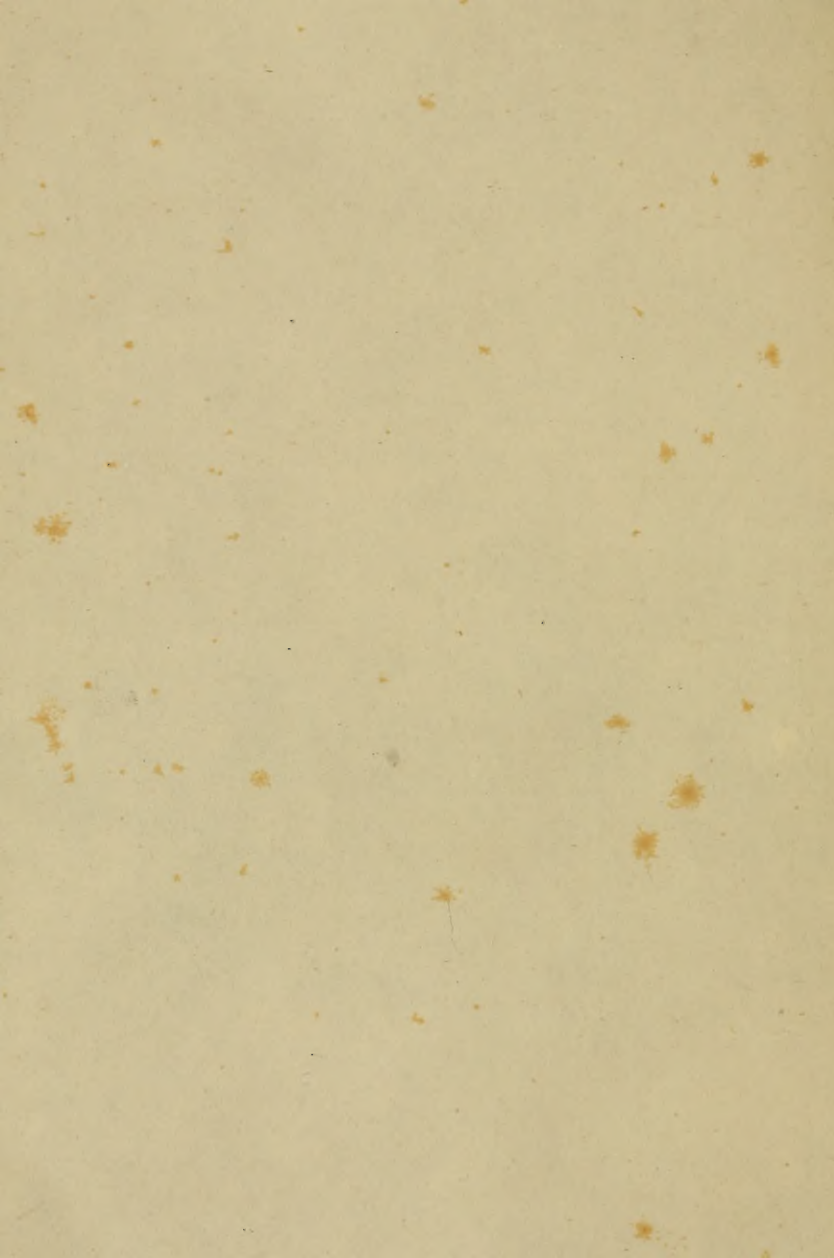
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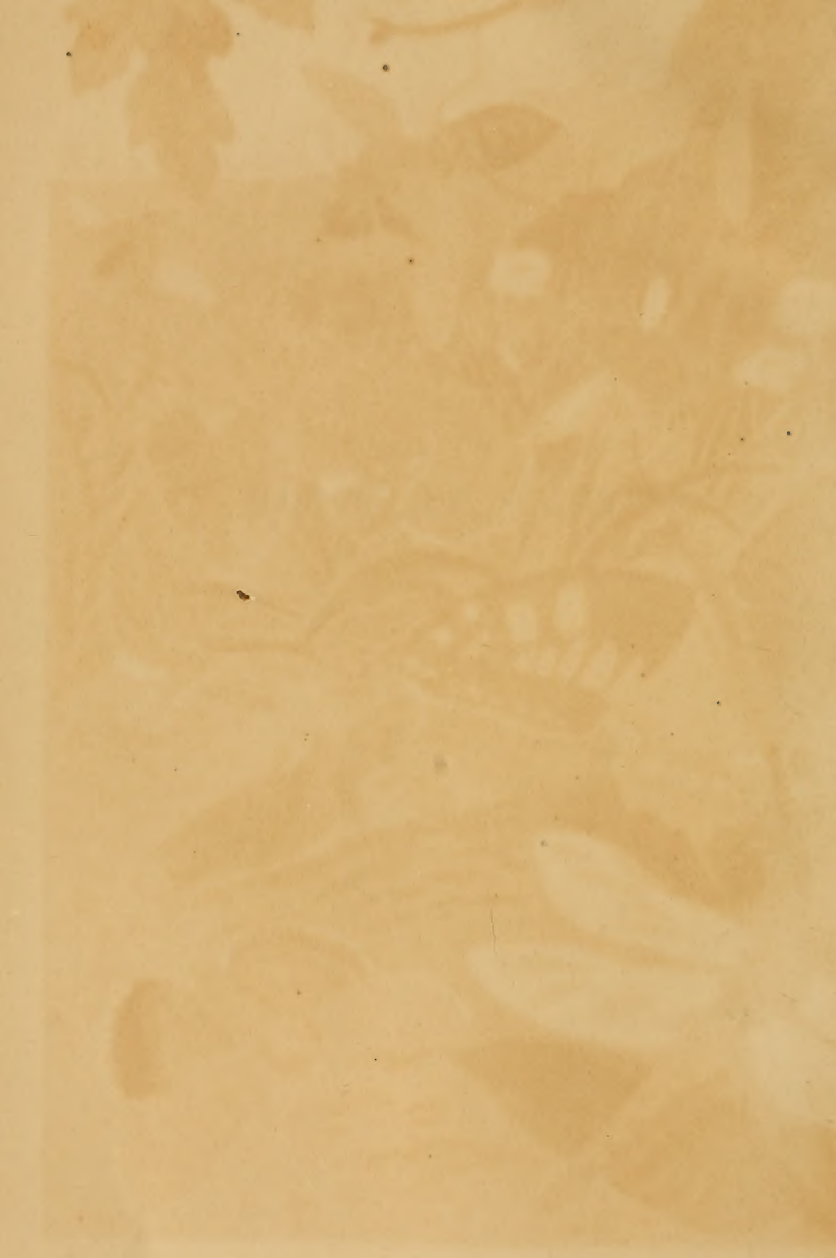
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INSECTS AT HOME.





INSECTS AT HOME.

BEING A POPULAR ACCOUNT OF

I N S E C T S ,

THEIR

STRUCTURE, HABITS, AND TRANSFORMATIONS.

BY THE

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AUTHOR OF

'HOMES WITHOUT HANDS' 'BIBLE ANIMALS' 'COMMON OBJECTS OF THE SEA-SHORE AND COUNTRY'
ETC.

WITH UPWARDS OF 700 FIGURES BY E. A. SMITH AND J. B. ZWECKER,

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P R E F A C E.

As this is not a work on comparative anatomy, but treats of 'Insects at Home,' a greater stress is laid on the habits of the insects than on their anatomy. Still, inasmuch as a general knowledge of the various parts of an insect and of the terms applied to them is absolutely necessary for all who wish to study the subject, however superficially, I have given, together with the different groups of insects, those portions of their structure which serve to distinguish them from their fellows.

Moreover, there will be found prefixed to the description of the chief groups chart-drawings of their anatomy, so as to enable the reader to recognise the various portions of an insect when he examines it. I am led to do this by the remembrance of the difficulties undergone by myself during my earlier years of entomology. In those days the only works which gave illustrations as well as names were so few, and so costly, that they were positively out of my reach as much as if they had never existed. I have therefore endeavoured in this work to supply that want which I felt so severely, and have so arranged the work that no reader need be puzzled as to the difference between mandible, maxilla, labium, and mentum, as I was in former days. For example, the chart-drawing on page 9 describes fully the structure of a Beetle, and is in fact a key to that of all insects; that on page 296 gives all those

points in which the Bees, Wasps, Ants and their kin differ from the Beetles; and that on page 385 performs the same service with regard to the Moths and Butterflies.

In the Woodcuts which are inserted in the text the numbered figures represent insects, and those to which letters are attached represent the most important details of those insects. It is by means of such details that entomologists are enabled to arrange insects in some definite system, and so to enable anyone who is acquainted with them to identify an insect which he has never before seen.

The reader may probably notice that these figures of insects are but slightly shaded, and in many cases are little but outline. This is intentional, and the shading is omitted in order that the reader may supply its place by colour. In every case where red, yellow, or light hues of any tint are to be used, their place is left as nearly blank as possible; and, as the insects are described fully in the text, there will be no difficulty in applying the colours. I would recommend a liberal use of ox-gall in mixing the colours, so as to neutralise the oily lines of the printer's ink.

Should the reader wish to colour the page-size engravings, he must first prepare them with a little size, or otherwise the colours will run. It will be found better, in order to bring out the insects more boldly, either to leave the background uncoloured, or to put in the colours as lightly as possible. I very strongly recommend the possessor of the work to colour these illustrations, as he will thus fix the insects firmly in his mind, and quadruple the value of the volume to other readers.

October 1871.

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ILLUSTRATIONS.

PLATES.

FRONTISPIECE.

1. Tiger Beetle (*Cicindela campestris*) on the wing.
2. Great Green Grasshopper (*Acrida viridissima*) depositing its eggs in the ground.
3. Dragon Fly (*Æschna grandis*) in chase of prey.
4. Great Sirex (*Sirex gigas*) depositing its eggs.
5. Hornet (*Vespa crabro*) eating a Red Admiral Butterfly.
6. Swallow-tail Butterfly (*Papilio Machaon*) flying.
7. Light Crimson Underwing (*Catocala promissa*) flying.
8. British Cicada (*Cicada anglica*) flying.
9. Humble-Bee Fly (*Bombylius medius*) feeding while on the wing.

PLATE I.

TIGER BEETLES AND BOMBARDIER. To face p. 16

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2. *Cicindela maritima* and larva.
3. *Cicindela germanica* and larva.
4. *Broscus cephalotes*.
5. *Brachinus crepitans*.
6. *Carabus monilis*.

PLANTS :—

Bramble (*Rubus fruticosus*). Above.
 Heath (*Erica cinerea*). Right of middle.
 Lavender Thrift (*Statice Limonium*). Left of middle.
 Fern (*Pteris aquilina*). Above heath.

PLATE II.

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2. *Calosoma inquisitor*.
3. *Carabus intricatus*.
4. *Cychrus rostratus*.
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6. *Carabus*, larva.

PLANTS :—

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6. *Gyrinus natator*, pupa case (on arrow-head).

PLANTS :—

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 Creeping Mouse-ear (*Myosotis repens*). Right upper corner.
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8. *Hister bimaculata*.
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12. *Silpha thoracica*, larva.
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PLANT:—

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3. *Geotrupes stercorarius*.
4. *Lucanus cervus*.
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6. *Cetonia aurata*, larva (three parts grown).
7. *Cetonia aurata* (pupa cases or cocoons).
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PLANT:—

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 4. *Rhyssa persuasoria*.
 5. *Rhyssa* depositing eggs.
 6. *Chelonus oculator* (rather magnified).
- Caterpillar of Death's Head Moth.
In middle.

PLANTS:—

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3. *Eumenes* and nest.
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7. *Cilissa hæmorrhoidalis*.
8. *Nomada ruficornis*.
9. *Stylops melittæ*.

PLANTS:—

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nest of *Eumenes*.

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2. *Bombus muscorum* (female).
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DELTOIDES, TORTRICES, TINEÆ,
AND PTEROPHORI.

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7. *Nepticula aurella*.
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PLANTS:—

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Above.White Dead Nettle (*Lamium album*).
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INSECTS AT HOME.

CHAPTER I.

INTRODUCTION.

THERE is scarcely a branch of science, however interesting it may be, which does not at first repel the intending student by the array of strange words with which the treasures of knowledge are surrounded. This is especially the case in Botany and Zoology, which contain, in addition to the usual technical language, vast numbers of names belonging to various plants or animals, each name consisting of two words, one denoting the genus and the other the species.

That many have been deterred from pursuing a study hedged about with such difficulties is not a matter of wonder, and it is much to be regretted that writers on science too often increase rather than lessen the difficulties by their purely technical mode of handling the subject. The real cause of the general repugnance to science is to be found in the mode of writing adopted by too many scientific writers, who forget the first principles of instructive writing, and do not identify themselves with the minds of those whom they are endeavouring to teach.

The study of ENTOMOLOGY, or the knowledge of insects, has greatly suffered from this cause. It is one of the most fascinating of pursuits. It takes its votaries into the treasure-houses of Nature. and explains some of the wonderful series of links which form the great chain of creation. It lays open

before us another world, of which we have been hitherto unconscious, and shows us that even the tiniest insect, so small perhaps that the unaided eye can scarcely see it, has its work to do in the world, and does it. Among the insects, too, we find not only instinct, but reason. We find that in these lesser creatures the passions and emotions of humanity have their counterparts. Love, for example, develops itself in many ways, and so does hate; and, indeed, if the whole list of human qualities be examined, there is scarcely one which cannot be found in the insect world.

The habits of insects are very mines of interesting knowledge, and it is impossible carefully to watch the proceedings of any insect, however insignificant, without feeling that no writer of fiction ever invented a drama of such absorbing interest as is acted daily before our eyes, though to indifferent spectators. Thus, even in the mere structure of insects there is more than enough material for the study of a lifetime. Putting aside the wonderful internal mechanism, which ought to be examined when practicable, the outward form is full of interest. We find among insects a variety and brilliancy of colour that not even the most gorgeous tropical flowers can approach, and that some of our dullest and most insignificant little insects are, when placed under the revealing lens of the microscope, absolutely blazing with natural jewellery. The variety of form, too, is quite as boundless as that of colour, so that there is much excuse even for the mere collector, who cares nothing for insects unless he can kill them and set them in rows in a cabinet.

In the following pages I intend to describe, as far as possible within so limited a space, *INSECTS AT HOME*, and, though giving the needful scientific information, to use few technical terms, and always to explain those which of necessity must be employed.

Our first business is evidently, when treating of Insects at Home, to define precisely what an insect is. This seems to be a simple matter enough; but it really is not so, the question being one which has occupied systematic zoologists for many years, and which is even now rather a dubious one in several cases. The word insect is, as a rule, employed very loosely by those who have not studied the subject. Spiders, for example, are generally called insects, and so are woodlice, centipedes, and a variety

of other creatures which have really no right whatever to the title. We will therefore see what an insect really is.

Insects are technically described as being '*articulated animals, breathing by tracheæ, divided into three distinct portions—viz. the head, the thorax, and the abdomen—passing through a series of transformations, and having in the perfect or "winged" state six articulated legs and two antennæ.*'

We will now take this description and examine it in detail. The articulated animals are formed on a totally different plan from the vertebrates, molluscs, radiata, or other divisions of the animal kingdom. Their bodies are formed of a series of flattened rings, within which are contained all the muscles and vital apparatus. It will be seen that a vast number of animals come within this definition, which includes not only the insects, but the Crustacea, such as the crabs, lobsters, shrimps, woodlice, and others; the Arachnida, such as the spiders, scorpions, and mites; the Myriapoda, such as the centipedes and millipedes; and the Annelida, of which the common worm is a familiar example. It is necessary, therefore, to find some mode of distinguishing the insects from all the other articulates, and, after much trouble, systematic naturalists have agreed upon the short formula which has already been given.

It is there stated that insects breathe through '*tracheæ.*' Now tracheæ are tubes composed of thin membranes, kept open by a fine but stiff wiry thread, which is twisted spirally throughout the whole course of the tube, just as a modern flexible gas-tube is kept open by a spiral wire, no matter how it may be twisted or bent. This is absolutely necessary in insects, for the tracheæ are not confined to a single portion of the body, like the lungs of men or the gills of fish, but permeate the entire insect, passing through all the limbs, and even reaching to the claws which terminate the feet. Any of my readers who wish to see the extraordinary manner in which the breathing apparatus is disposed over the whole body should look at the plates of Strauss Durekheim's wonderful work on the common cockchafer, a work to praise which would be simply impertinent.

I strongly advise all my readers to examine these marvellous structures for themselves. There is not the least difficulty in

finding them, for the real difficulty is to dissect any part of the body without finding them. The largest of these tubes are those which run along the sides of the insect, and are connected with the oval openings along the sides, which are possessed by every insect. These openings are called spiracles, from the Latin word *spiro*, because through them the insect breathes. Any insect or caterpillar will furnish the tracheæ, but the larger the better. They should be severed from the body by a pair of fine scissors, then taken out with a pair of forceps, and laid on a glass slide. I have now before me a preparation of the tracheæ of a silkworm which I made twenty-two years ago, and it is not the least damaged by keeping.

These tracheæ afford a most important characteristic of the insects, inasmuch as the Crustacea do not possess them at all, and the Arachnida generally, though not always, breathe by means of internal air-sacs.

Next, the creature must be divided into three distinct portions. This is the signification of the title Insect, which is derived from two Latin words, signifying cut-into, while the familiar Greek name of Entomia (from which the word entomology is formed) has precisely the same signification. This is, perhaps, the most important of all the characteristics, as in the Crustacea and Arachnida the head is merged into the thorax, so that they are divided into two portions instead of three; while in the Myriapoda and Annelida there is no distinct thorax, and sometimes scarcely a distinct head.

Next we come to the transformations which insects have to undergo before they reach their perfect or adult state. All animals really undergo a course of transformation, but in the insect they take four very distinct forms; namely, the Egg, the Larva (i.e. caterpillar or grub), the Pupa (or chrysalis), and the Imago, or perfect insect. Any of my readers who have had silkworms will be practically acquainted with this fact, and will also know that the larva changes its skin, or moults, several times before it assumes the pupal form. The reason for this casting of skin is evident. The larva, like the perfect insect, is made of a series of flattened rings, or rather, of a double series of half rings, connected along the sides by an elastic membrane, so as to permit the creature to breathe and eat.

Now, the upper and lower portions of these rings are comparatively inelastic, and cannot themselves expand, though they can be opened wider at the sides in proportion to the interior expansion of the body. Meanwhile, the larva continues busily its sole business, that of eating, and increases rapidly in size, so that, within a certain time, its skin is stretched to the utmost, and can expand no more. Still the larva continues to increase, though its tight integuments cause it so much uneasiness that it ceases to eat, and at last the overstretched skin bursts, and the larva emerges, clad with a new skin, which has been forming under the old one. As soon as it is free, it takes a number of deep respirations, and in half an hour, or thereabouts, is so much larger than its cast skin, that to put it back again would be fatal. This process is repeated until the larva is about to assume the third or pupal state.

In consequence of this mode of development, the whole of the growth is completed during the larval state, and, however long an insect may live, it never grows after it has attained its perfect form; and, though it is common enough to find insects though of the same species yet of very different sizes, the larger have not grown since their last change, nor will the small specimens ever attain the dimensions of their larger relatives. In a measure, the same rule prevails among mankind, and, though some may be giants and other dwarfs, the dwarf will never become a giant, nor has the giant ever been a dwarf, and, different as are their sizes, both ceased to grow when they attained the age of manhood.

The modes of passing through the successive changes of form are exceedingly variable in the different orders of insects, and are always most interesting to careful observers. I shall not mention them in this place, but shall give the descriptions of the metamorphoses together with the history of the different species.

Next in order comes the statement that all true insects have six legs when they have attained the perfect form, or Imago. The reader will see that this definition at once excludes all other Annulata. The Crustacea, for example, have a considerable number of legs, and the Arachnida are eight-legged, while the Myriapoda are, as their name infers, many-legged, and the Annelida have no legs at all. It is true

that in some insects there only appear to be four legs, but, in these cases, the apparently missing organs may be discovered on careful examination, much reduced in size, but still present.

A similar observation may be made with regard to the antennæ, or, as they are popularly called, 'horns,' or 'feelers.' The word antenna is a Latin one, signifying the yard-arm of a ship, and has been appropriately given to these organs. In most cases the antennæ give great character to the aspect of an insect. In some of the Beetles, for example, they are slender, and each joint is so lengthened that the antennæ are five times as long as the body. In others they are comparatively short, sometimes deeply toothed like combs, sometimes terminated with a round club, sometimes with the ends developed into a beautiful fan-like apparatus, and sometimes looking like a number of coins joined together by a string running through their centre. The knob-tipped antennæ of the butterflies are an unfailing characteristic whereby these insects can be distinguished from the moths, with their sharp-tipped antennæ; while in the latter group of insects, the antennæ of the male are often wide and feathered, those of the female being mere jointed threads, without any feathering whatever. Many insects seem to be altogether without antennæ, but, like the undeveloped legs already mentioned, they can be found in their places, though so small as to escape a hasty observation.

HAVING now briefly examined the general characteristics of insects, we will take them in detail.

Among the insects, the COLEOPTERA, or BEETLES, are acknowledged to hold the first rank, their development being more perfect than is found in any of the other orders. The name of Coleoptera is composed of two Greek words, signifying sheath-wings, and is given to this order of insects in consequence of their leading peculiarity, which is, that the upper pair of wings is modified into horny or leathery cases, called elytra, useless in flight, but employed in protecting the membranous under pair of wings, which alone are used in flight. In many Beetles the lower pair of wings is not developed, and in a few both pairs are practically wanting, though the practised eye can always detect them in a rudimentary form. The wings and

elytra, together with other portions of the Beetle, will presently be figured and described.

The changes, or metamorphoses, of the Beetles, though singularly interesting, are not easily seen, as Beetle larvæ require food which is, as a rule, not easily procured, and in many cases is so noisome that few persons would like to meddle with it. A great number are carnivorous, feeding upon various living creatures, so that to supply them properly with food is next to impossible; while, as the majority of them pass two years or more in the larval state, the process of rearing them is tedious as well as difficult.

All who have had silkworms, or have been in the habit of watching insects when at liberty, are familiar with the appearance of the three principal forms assumed by the moths and butterflies in their different stages of growth—the caterpillar, with its soft, cylindrical, ringed body, the pupa or chrysalis, covered with a hard, shelly case, and the perfect insect, with its beautiful wings. Now, although the Beetles pass through similar changes, they do not assume similar forms. The larva of the Beetle is, like that of the moth or butterfly caterpillar, soft and ringed, and sometimes so resembles the caterpillar that it may easily be mistaken by anyone unskilled in entomology. Figures of the larvæ will be given in connection with the different species.

Thus far the Beetle and moth bear some resemblance to each other, but when they come to assume the pupal form, they are so dissimilar that no one could possibly mistake one for the other. In the moth pupa all the limbs are hidden under a hard covering, but in the Beetle pupa all the members of the insect are visible, though they are covered with a skin which binds them down, and prevents them from being used until the insect attains its perfect form, and bursts through the investing skin. A figure of the larva and pupa of a Beetle may be seen by referring to the Bacon Beetle (*Dermestes lardarius*), Woodcut XI.

If the reader will carefully examine the various stages of insect life, he will see that, whether the creature be in the larval, pupal, or perfect state, the number of rings of which it is composed are the same. Take, for example, a Beetle larva, and it will be found to consist of thirteen rings, or

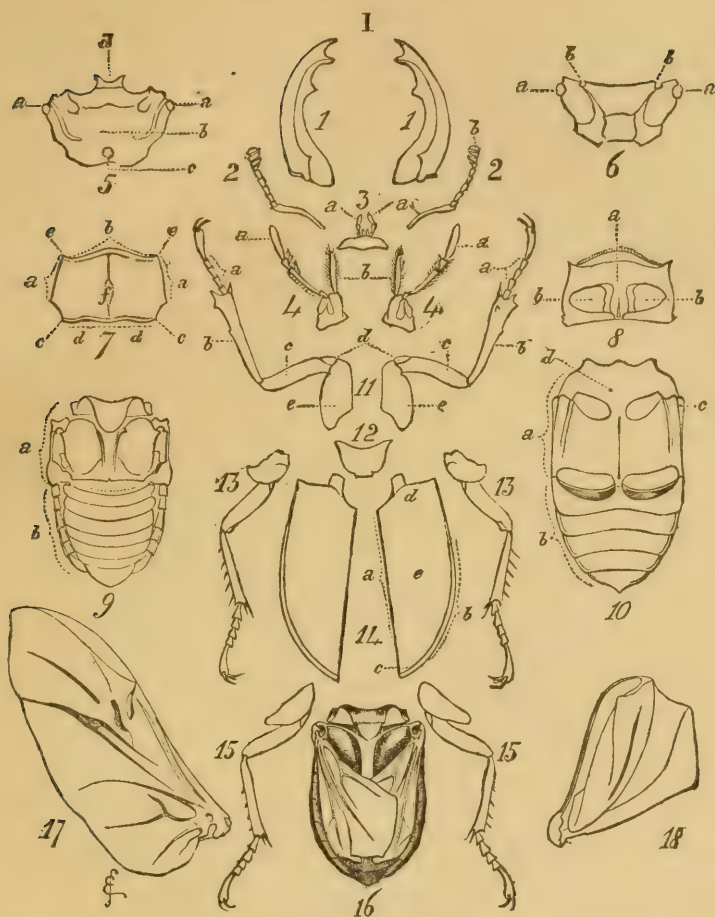
segments. The first of these forms the head, the next three carry the legs, and the remaining rings constitute the body. Should the same larva be successfully reared, and examined after it has reached the perfect state, it will be found to have precisely the same number of rings, though some are fused together, and others are greatly modified.

There are few things more marvellous than the development of a Beetle—say, for example, the Stag Beetle, because we shall presently examine one of these insects in detail. In its larval state it is a large, fat, soft grub, with legs so disproportioned to the size of its body that it cannot walk, but can only move about while lying on one side. It lives in the dark, buried in the interior of some tree, and feeds upon the fragments of wood which it bites off with its short but sharp and powerful jaws. In its perfect state, it is furnished with highly developed legs, with two wide and powerful wings, sheltered under their horny elytra, with an elaborately organised mouth, and two enormous jaws, while the antennæ and eyes are in themselves absolute wonders of mechanism. The larva of this Beetle is almost exactly like that of the cockchafer, shown in Plate V.; and the reader will see that it is hardly possible to imagine a more complete contrast than exists between the very shapeless grub and the insect in its perfect form.

In the accompanying illustration we have an example of the Beetle, taken to pieces so as to show the various parts. The Stag Beetle has been chosen for the purpose.

We begin with the head and its appendages. Fig. 1 shows the mandibles, or upper jaws, which in the male Stag Beetle are of very great size. Fig. 4 shows the maxillæ, or lower jaws, with the maxillary palpi, or jaw-feelers, Fig. 4*a*. Fig. 3 shows the labium, or lower lip, with the labial palpi, or lip-feelers, 3*a*. Next come the antennæ, or feelers, Fig. 2. These organs are divided into two parts—namely, the scape, or long joint nearest the head, Fig. 2*a*, and the club, 2*b*. This latter portion is subject to most extraordinary variations of form, as will be seen in the following pages.

The head itself is shown at Fig. 5, the upper surface being here given. 5*aa* are the eyes, 5*b* the vertex, or crown of the head. 5*c* is the occiput, or back of the head; and 5*d* the



LUCANUS CERVUS. DISSECTION.

Parts of the Head.—1. Mandibles, or jaws. 2. Antennæ. 2a. Scape. 2b. Club. 3. Labium, or lower lip. 3a. Labial palpi, or lip-feelers. 4. Maxillæ, or lower jaws. 4a. Maxillary palpi, or jaw-feelers. 5. Head, upper surface. 5a. Eyes. 5b. Vertex, or crown. 5c. Occiput, or back of head. 5d. Clypeus, or shield. 6. Head, under surface. 6a. Eyes. 6b. Insertion of antennæ.

Parts of Thorax and Abdomen.—7. Pronotum, or upper surface of thorax. 7a. Lateral margin. 7b. Anterior margin. 7c. Posterior angles. 7d. Posterior margin. 7e. Anterior angles. 8. Prothorax, or under surface of thorax. 8a. Sternum. 8b. Insertion of coxæ. 9. Mesothorax and upper surface of abdomen. 9a. Mesothorax alone. 9b. Abdomen, upper surface alone. 10. Metasternum and abdomen. 10a. Metasternum alone. 10b. Abdomen, under surface alone. 10c. Parapleura, or side pieces. 10d. Episterna, or breast-pieces. 12. Scutellum.

Legs.—11. Anterior, or first pair of legs. 11a. Tarsi, or feet. 11b. Tibia, or shank. 11c. Femur, or thigh. 11d. Trochanter. 11e. Coxa. 13. Intermediate pair of legs. 15. Posterior pair of legs.

The Wings.—14. Elytra. 14a. Suture. 14b. Lateral margin. 14c. Apex. 14d. Base. 14e. Disc. 16. Wings folded on abdomen. 17. Left wing expanded. 18. Right wing folded.

clypeus, or shield, which covers the actual mouth. Fig. 6 shows the under side of the head. 6aa are the eyes, 6b the insertion of the antennæ.

As reference has been made to the eyes, it must be mentioned that these organs, although apparently only two in number, are in reality compound eyes, being made of a vast number of facets gathered into two groups, one on each side of the head. There is an apparent exception to this definition in the well-known Whirligig Beetles (*Gyrini*), which appear to have four eye-groups, two above and two below. This exception is, however, more apparent than real; the eye-groups being in fact only two, but each pair being crossed by a band of the horny material of which the outer skeleton is composed. The compound eyes can be seen to great perfection in some of the butterflies; but for this purpose, a careful manipulation of the microscope is needed.

If the reader should be disposed to prepare a portion of the compound eye for the microscope, he will find that the operation, though a rather tedious one, will well repay him for the trouble. Should he wish to do so, he can so arrange the eye that some small object can be seen through it, when the effect will be extraordinary, the object being apparently multiplied in accordance with the number of facets in the field of the microscope. The result is, in fact, exactly the same as that which is produced by looking at any object through an ordinary multiplying glass. It is not, however, to be imagined that because the compound eye of the insect has so many facets, the insect perceives the object multiplied in proportion to the facets; for, although the numerous facets give the insect an extended range of vision, they convey but one image to the brain, just as the duplicate eyes and ears of man convey to the mind but one image and one sound.

In addition to these compound eyes, many insects possess several small simple eyes, called ocelli. They are very small, and in the Beetles are two in number, and placed on the back of the head. They can be very easily seen in some of the Hymenoptera, such as the bees and wasps. The eyes of the spider are of a similar character.

HAVING examined the head, we now take the next division of

the insect, namely the thorax. This important part bears all the instruments of locomotion, whether they be legs or wings; and is most wonderfully constructed for the purpose, being supplied in the interior with hard projections that are needed for supporting the powerful muscular apparatus needful for flight, and the less powerful, but still important system by which the legs are moved.

The thorax is internally divided into three parts, which we call prothorax, or front thorax; mesothorax, or middle thorax; and metathorax, or hinder thorax. Beginning with the prothorax, we find it again divided into two portions, the upper and the lower—the former going by the name of pronotum, i.e. in front of the back, and the other called prosternum, i.e. in front of the breast. Fig. 7 shows the pronotum of the Stag Beetle: *7aa* are the lateral margins, *7b* is the anterior margin, *7cc* are the posterior angles, *7d* the posterior margin, and *7ee* the anterior angles.

Next we come to the prosternum, which is shown at Fig. 8; *8a* being the sternum, and *8bb* the insertion of the coxa, a joint which will be presently described.

The mesothorax with the abdomen is shown at Figs. 9 and 10, the former exhibiting the upper, and the latter the under surface. In the last figure, *a* is the metasternum, *b* the abdomen, *c* the parapleura, or side-pieces (sometimes called paraptera, because they are situated by the wings), and *d* the episterna, or breast-pieces.

Each of these portions is set apart for a definite use, and is employed for the attachment of some portion of the locomotive apparatus.

The prosternum is used to carry the front pair of legs, as can be seen by looking at the under side of any large Beetle, or indeed of any small one, by the aid of a magnifier.

The mesothorax bears the elytra, or wing cases, and the intermediate pair of legs, the former being attached to the upper part, or mesonotum, and the latter to the lower part, or mesosternum. The reader must remember that the word 'sternum' always signifies the breast, or under side of the thorax, and 'notum' the back, or upper side. Lastly, the mesothorax bears the lower, or membranous, wings and the last pair of legs. As before, the wings are attached to the

upper part, or metanotum, and the legs to the lower part, or metasternum.

We come now to the legs, the three pairs of which are represented successively at Figs. 11, 13, 15; the first pair being called the anterior legs, the second the intermediate legs, and the third the posterior legs.

These legs are divided into several portions, which are marked at Fig. 11. Beginning at the extremity of the limb, *a* is the tarsus, or foot, which consists of several joints. There are mostly five joints in the tarsus of Beetles, but in many families one or two of the joints are so small as scarcely to be visible, and only to be detected by a practised eye with the aid of a lens. Next comes the tibia, or shank, which is shown at *b*. Then follows the femur, or thigh, as seen at *c*. This is attached to a small joint called the trochanter, which is drawn at *d*; and last comes the coxa, or the joint which connects the limb with the thorax. The action of the coxa is very curious, it being a kind of ball-and-socket joint, but with a limited range of movement, so that the legs cannot be spread too far. The same divisions of the joints are found in the three sets of legs.

We next come to the wings. The upper pair, or elytra, are shown at Fig. 14. For convenience of description they are marked into several divisions. Fig. 14*a* is the suture, or line of junction between the two elytra. The apex is shown at *c*, and the base at *d*. The middle, or disc, is marked *e*, and the lateral margin is at *b*. Fig. 17 shows one of the wings expanded, as if for flight; Fig. 18 is the opposite wing, represented as folded, and at Fig. 16 are shown both wings as they appear when the elytra are removed.

At first sight some of these terms may appear to be harsh, repulsive, and difficult to master. In reality they are not so, and a knowledge of them is absolutely necessary to anyone who wishes to understand the description of an insect, and himself to describe insects intelligibly. They form a kind of shorthand by which knowledge can be rapidly communicated, and the trouble taken in learning them is amply repaid by the advantage gained by the student, even were the trouble multiplied tenfold.

But, in reality, there is scarcely any trouble needed. If the

intending entomologist should content himself with merely learning a string of names by rote, he must expect to find his lesson a hard and repulsive one, and that it will be forgotten almost as soon as learned. Practical knowledge is ever the best, and the reader who intends to become an entomologist should take some Beetle—the largest he can find—and compare it, piece by piece, with the figures and description.

The most effective plan of all, however, is to take the Beetle entirely to pieces, and to lay out the portions on a card in their proper order, numbering each piece, and writing an index to the numbers. The various portions can be fixed to the card by diamond cement or Kay's coaguline, the latter having the advantage of great holding power, so that a very little is required, perfect transparency, and sufficient elasticity to guard against the tendency to chip away from the object, which is so unpleasant in ordinary gum. I recommend taking two Beetles, so as to show the upper and under sides of each portion. This will be found peculiarly interesting in the thorax.

Before any attempt at dissecting the Beetle it should be steeped in soft water for a time, until the soft parts are thoroughly dissolved. The water should then be poured away, and fresh water substituted until the whole of the muscles and viscera have been washed away. Care must be taken lest any of the smaller joints be lost during this process. When the whole skeleton is fairly laid out, it can be mounted in a glass frame, and, besides serving as an infallible guide to the external anatomy of the Beetle, it is really a pretty and ornamental object. Many years ago, when I first began the study of entomology, I thus prepared several Beetles, and the knowledge thus gained has never been lost. Had I studied books alone, I should not have been able to gain the information half so easily, or to have retained it half as long.

CHAPTER II.

THE GEODEPHAGA.

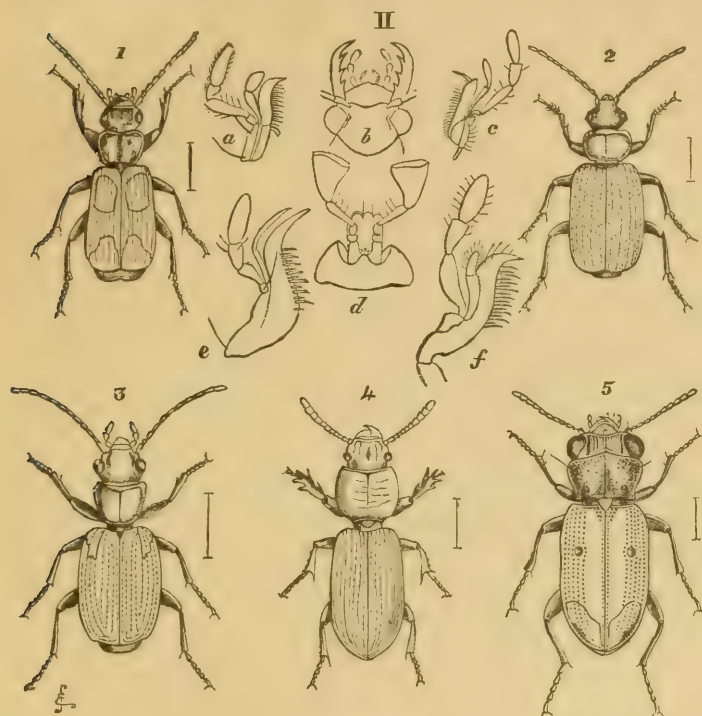
THE word with which this chapter is headed is not a very alluring one, and yet to an entomologist it would say that the chapter contains the history of the best developed and some of the most interesting of the British Beetles. The term Geodephaga is formed from two Greek words, signifying earth-devourers, and is given to the large group of predacious Beetles which live on the ground. There is another large group, called the Hydradephaga, or water-devourers, i.e. those predacious Beetles which inhabit the water. We will take these two important groups in succession, selecting such examples as may best illustrate them.

It must be, in the first place, observed that any Beetle may be recognised as belonging to either of these great groups by the structure of the mouth. In reference to the illustrations already described, the reader will see that each of the maxillæ (Fig. 4) is furnished with a four-jointed maxillary palpus. All these carnivorous Beetles possess the same organs, but, in addition, they have an inner lobe, which is also furnished with its palpus. Several examples of this structure may be seen by reference to the accompanying illustration (Figs. *a*, *c*, *e*, and *f*). Both these groups are associated in one large group called Adephaga, the word being a Greek one, and signifying greedy or gluttonous.

BEGINNING with the Geodephaga, we take the first family of the group, the Cicindelidæ, or Tiger Beetles. In all these Beetles there is a little movable hook at the end of the maxillæ, and the ligula is very short, and not appearing beyond the mentum. There is only one genus of these Beetles inhabiting England, and this is the typical genus *Cicindela*. The

members of this genus vary but little in size, being about half an inch in length, having slender legs and antennæ, powerful and curved jaws, and very rounded and prominent eyes. They are all prettily coloured, and some are absolutely magnificent when viewed with the aid of a magnifying glass.

Never was a popular name more appropriate than the title of Tiger Beetles, which has been given to this genus. If we



COLEOPTERA.

1. *Dromius quadrimaculatus*. 2. *Lebia cyanocephala*. 3. *Tarus axillaris*. 4. *Clivina fossor*. 5. *Notiophilus biguttatus*. a. *Dromius*, maxilla. b. *Cicindela*, head. c. *Cicindela*, maxillary palpus. d. *Tarus*, labial palpi. e. *Notiophilus*, maxillary palpi. f. *Lebia*, maxillary palpi.

can imagine tigers who, in addition to active limbs, their teeth, and their talons, are furnished with large and powerful wings, we can form some idea of the part which these creatures play in the world of insects.

We will take as our first and typical example the common GREEN TIGER BEETLE or SPARKLER (*Cicindela campestris*).

At Fig. *b* of Woodcut II. is shown the head of this insect, magnified some six diameters, in order to show the extremely formidable jaws with which it is armed. These jaws are not only sharp at their points, and strongly curved, but are boldly toothed; so that when the Beetle has once seized its prey, the unfortunate insect has but little chance of escape.

The colour of this beautiful beetle is gold-green above, and shining copper-green below; and there are several yellowish spots on the elytra, varying much in shape, number, and hue. Sometimes there are only three, but in many specimens there are six. In former times, the variety in the number of spots was thought to indicate that the Beetles belonged to different species, but it is now decisively ascertained that they are only varieties of one single species.

When this Beetle is casually examined, the elytra and head seem to be merely dull green, but when a powerful light is brought to bear on them, and they are placed under a trustworthy lens, they absolutely blaze with gem-like hues, so that the eye is almost dazzled with their splendour. Scarcely any two specimens are exactly alike, but in all there is a brilliant metallic resplendence, sometimes as of pale gold, and sometimes as of red gold.

If the wing-cases be opened, and the broad membranous wings spread, the upper surface of the abdomen is seen to be deep shining blue, very much like the colour of the ordinary 'blue-bottle' fly. As the Beetle darts through the air in the sunshine, the light glitters on the burnished blue surface, a circumstance which has earned for the Beetle the popular name of Sparkler.

One peculiarity of this insect is the strong but pleasing scent which it emits. I well remember the first time that I saw and captured this Beetle. It was on a sandy bank in Bagley Wood, near Oxford, and I could not for some time guess the origin of the pleasant, sweet-briar sort of scent which clung to my hands. For some time I thought that I must have grasped some fragrant herb, and it was not until I had taken the Beetles out of the box (where, by the way, nearly one half had been killed and partly eaten by the other half) that I discovered the real source of the perfume.

The habits of all the species being very similar, we will pass to another insect belonging to the same genus.

PLATE I.

TIGER BEETLES AND BOMBARDIER.

1. *Cicindela sylvatica* and larva.
2. *Cicindela maritima* and larva.
3. *Cicindela germanica* and larva.
4. *Brosicus cephalotes*.
5. *Brachinus crepitans*.
6. *Carabus monilis*.

PLANTS :—

- Bramble (*Rubus fruticosus*). Above.
Heath (*Erica cinerea*). Right of Middle.
Lavender Thrift (*Statice Limonium*). Left of Middle.
Fern (*Pteris aquilina*). Above Heath.





ON Plate I. Fig. 1, is seen the WOOD TIGER BEETLE (*Cicindela sylvatica*). This, although a really beautiful insect, cannot lay claim to the splendid colouring which adorns its congener, the Green Tiger Beetle.

The colour of this insect is brown above, with a decided purple gloss. The elytra have a cream-white curved mark at the base, a narrow wavy mark of the same colour in the middle, and a round spot close to the apex. Below, it is deep bluish-green, often glossed with copper and purple.

This species is found in various parts of England, and chiefly haunts sandy heaths and similar places. The reason for this habit is, that in such localities the larva can find a home, and the perfect insect a livelihood. The larva of the Tiger Beetle is an odd-looking creature, having a broad flat head, armed with sickle-shaped jaws, and the two next segments very large. The eighth segment is developed to an extraordinary degree, and is furnished on the back with two large tubercles crowned with reddish bristles, and carrying two sharp recurved hooks, the use of which will presently be seen. In consequence of this peculiar form, the larva has been compared in shape to the capital letter Z. The colour is whitish.

These odd-looking larvæ are burrowers, making tunnels in the sandy soil nearly eighteen inches in depth, and a little wider than the diameter of the body. They excavate in rather an ingenious manner. With their jaws, assisted by their front pair of legs, they scrape away the sand, and allow it to rest upon the flat broad head. They then work their way up the tunnel, and, when they have reached the orifice, throw off the burden. The creature intends to make a perpendicular burrow, but is sometimes obliged to alter its shape, in consequence of coming across a stone or a furze-root. Sometimes, if a stone or root happens to be a large one, the larva is obliged to abandon its unfinished task, and begin another tunnel.

On Plate I. are shown the tunnels of several species of *Cicindela*; the larva being shown in the burrow, and the perfect insect near its mouth. The third burrow, that of *Cicindela germanica*, is represented as only partially completed, so that the larva might be shown in its attitude of repose.

When the larva feels hungry, which is generally the case, it ascends to the mouth of the tunnel, and anchors itself there by

pressing the points of the hooks against the sides, so that no muscular exertion is required in order to keep itself from falling down the burrow. It then opens its jaws widely, and waits for prey. In this position it is all but invisible; and many a small insect runs heedlessly within its reach, and is instantly seized in the terrible jaws. No sooner is the capture made than the *Cicindela* larva retires to the end of its tunnel, and there devours its prey in peace. At Fig. 3 of Plate I. is shown the larva at the bottom of the burrow, engaged in eating an ant which it has just caught.

It is not very easy to procure the larvæ, even in places where they are tolerably common. In the first place, their peculiar mode of life keeps them much out of sight. The mouth of the burrow is not large; and when the larva suspects danger, it immediately retreats to the bottom of its tunnel, and there waits until it feels that the danger has passed by. In the next place, even when the creature has been detected, to capture it is a difficult task, owing to the nature of the soil, which is apt to fall in when disturbed, and so to fill up the burrow and hide the inhabitant. The best plan for catching these creatures without injuring them is to introduce into the burrow a flexible grass-stalk, or something of the same nature, and to pass it gently down to the very bottom of the tunnel in which the larva is lying. By carefully digging around the grass-stalk, the hidden grub can be secured.

More care is required in this operation than might at first seem to be needful. The trowel or 'digger' should be put into the ground at least eight inches from the mouth of the burrow, and quite a large hole should be dug; as, if it be made too small, the point of the trowel is apt to crush the soft-bodied grub. Then, the grass-stalk must be carefully held upright in the left hand, while the right hand is employed in digging; as, if unsupported, it is sure to fall out of the burrow as soon as the operator has dug within some two or three inches of the bottom of the hole, and then all the labour is lost. These larvæ may be found about May, and a second brood about August and the beginning of September.

Many insects are very voracious in the larval condition, but become comparatively indifferent to food when they reach their perfect state. This, however, is not the case with the Tiger

Beetles, which only cease from eating during the short period of their pupal existence. In localities which these insects prefer, such as sand-banks which are totally sheltered from the wind, they may be seen busily engaged in chasing their prey. They are more active in the air than any other Beetle, having a way of spreading and folding their beautiful wings so instantaneously that they look more like flies than Beetles. Most Beetles are very deliberate in preparing for flight and alighting after it, but the Tiger Beetles are quite exceptional in this respect, and dash about as easily as if their wings had not to be unfolded and repacked under the elytra.

ONE exception to the general rule is found in the *Cicindela germanica*.

This is the smallest of the British Cicindelidæ, being only five lines in length. Its body is rather cylindrical, and its colour is much like that of the first-mentioned species, the elytra being of a similar dull, but rich green. The elytra have a cream-white spot on the shoulder, one near the middle of the lateral margin, and a crescent-shaped mark at the apex. It is blue-green below, glossed with a copper tinge.

Contrary to the habits of the other Tiger Beetles, this species prefers wet to dry places, and has a liking for brackish marshes. It does not take to wing as do its congeners, but it is a very rapid runner, and traverses the wet surface of the ground with great speed. It appears to be one of those species which are at once intermittent and local in their appearance; being found plentifully in one season in some favoured locality, and then disappearing for years. Black Gang Chine, in the Isle of Wight, is said to be the place most frequented by this insect.

ANOTHER species, *Cicindela maritima*, is shown on Plate I. Fig. 2. It is purplish or coppery-chocolate above, the coppery hue being plainest along the suture; and the elytra have a cream-white mark at the base and apex, and a wavy band in the middle. It prefers the sand of the sea-shore, and may be found on many of our sandy coasts.

WE now come to the next family of British Beetles, the Lebiadæ. All the Beetles of this family may be known by the

appearance of the elytra, which do not extend to the end of the abdomen, and are abruptly squared, looking almost as if they had been cut off. If their first pair of legs be examined, the tibiae will be seen notched on the inner side. They are all rather small Beetles, and some are very prettily coloured. They are tolerably active when they choose to take the trouble of moving; but they are much given to hiding themselves in all kinds of crevices, so that some trouble is requisite in order to procure them.

The young entomologist must always bear in mind that the most unpromising localities will often prove to be singularly rich in insects, and that Beetles especially may be found in any spot where there is a crack or a hole. Large stones are nearly sure to shelter a Beetle or two beneath them; moss is generally full of them; and a heap of decaying grass or leaves is a hotbed which seems as well fitted to produce Beetles as to force plants. The loose bark of trees always has Beetles under it; and small Beetles creep into the burrows which larger Beetles have made in the decaying wood of the tree. When a quantity of long moss is to be seen, it is a good plan to fill a bag with it—a paper bag will do in lieu of anything better—and to bring it home, when it can be carefully examined by shaking it bit by bit over a large sheet of white paper. Grass-tufts can be treated in a similar manner, and mostly with great success. Lumps of dry earth can also be brought home, where they can be broken up and leisurely searched.

THE typical example of this family is shown on Plate II. Fig. 1. Its name is *Lebia crux-minor*. The insects belonging to this genus have hard and somewhat flattened bodies, and the antennæ rather thickened towards the tip. The second joint is the shortest, and the third the longest, the others being of about equal length. One of the maxillary palpi is drawn on Woodcut II. Fig. *f*.

The colour of this species is very decided. The head is black and 'punctated,' i.e. covered with minute holes or punctures, and the thorax and elytra are rust-red, the latter being marked with a bold black cross. No one can mistake this pretty Beetle who has once seen it; but, unfortunately, to see it except in cabinets is a very rare event, and any entomologist

who is fortunate enough to capture it, is sure to publish the fact. It is probably one of the intermittent and local species, as it has been taken in some numbers near the Devil's Dyke, at Brighton. The length of the Beetle is about a quarter of an inch.

ANOTHER species of this genus is drawn on Woodcut II. Fig. 2. This is called *Lebia cyanocephala*. The latter of these two words signifies blue-headed, and is given to the insect because its head, instead of being black, like that of the preceding species, is bluish-green. The thorax is rust-red, and is much punctated, and has a definite though slight groove along its centre. The colour of the elytra is somewhat variable, but is generally greenish-blue, in some specimens being almost entirely green, and in others almost entirely blue. It is bluish-green beneath.

The size of the insect is as variable as its colour, some specimens being quite a third larger than others. Its average length is a quarter of an inch, or rather less. It is not a common Beetle, but may be found upon the broom in the summer time.

THERE is a common species of this beautiful genus also to be procured from the broom. This is *Lebia chlorocephala*. It much resembles the preceding insect in colour, but may be known by the greater depth of the punctures on the head, and the longer and narrower thorax, with the posterior angles more pointed. Like the preceding insect, it is exceedingly variable both in colour and size. Mr. Stephens states that the specimens which he took from the broom in Epping Forest were scarcely half as large as those taken on the same tree in Darenth Wood, and that in the Epping Beetles the prevailing colour was blue, while in the Darenth specimens it was green.

THE genus *Dromius* comes next on our list. There are nine species of *Dromius*, all of them small and rather pretty insects. Although they are almost invariably found under the bark of trees, they must not be confounded with those little Beetles which devour the bark or bore into the wood. On the contrary, such insects constitute the food of the *Dromii*, so that

the latter ought to be encouraged and protected as far as possible. Their bodies are long and flattish, so as to enable them to run about under the bark in search of prey. The maxilla of a *Dromius* is shown on Woodcut II. Fig. *a*.

On the same illustration, at Fig. 1, is shown a Beetle which may be accepted as the type of the genus. Its name is *Dromius quadrimaculatus*, the latter name being given to it on account of the four white marks upon the elytra. The head of this species is black, and the thorax is rust-red. The elytra are brown, and each of them has two white spots, as shown in the illustration. The length of the Beetle is designated by the line drawn by its side. It can be taken in various localities. Throughout the year it can mostly be found by removing the dead bark of trees, but in winter it can sometimes be found under stones and in heaps of decaying leaves.

The word *Dromius* is of Greek origin, signifying a runner, and is given to the members of this genus in consequence of their activity.

THE members of the genus *Tarus* can be known by examining the structure of their mouths, and especially by looking at the labial palpi, which have the last joint very large, and shaped like an axe-head. This shape is technically termed by entomologists 'securiform,' from the Latin word *securis*, an axe or hatchet. The figure *d*, of Woodcut No. II., represents the labial palpi of a *Tarus*, and will at once explain the shape which the word securiform expresses.

On the same Woodcut, at Fig. 3, is drawn the owner of the securiform palpi in question, *Tarus axillaris*.

Three members of this genus are known to inhabit England. They are little Beetles, long bodied, and very flat, so as to enable them to creep into small crevices. They are sombre in hue, and not very easily distinguished from each other. Indeed, even expert entomologists have been perplexed about these Beetles, and some confusion has, in consequence, arisen respecting their nomenclature.

The present species is rather less than the third of an inch in length. Its colour is pitchy-black, but the thorax, legs, and antennæ are reddish, and the latter are downy at the tips. The elytra are very polished, and have bold striæ covered with

punctures, and there is a dull orange mark on the shoulder, a line of the same hue running along the lateral margin. None of the Tari are common, but they may be found near the sea-coast, hidden under stones in damp and marshy places.

If the reader will refer to Plate I. Fig. 5, he will see represented an event which frequently occurs in the insect world, and which, in spite of its frequency, never fails to attract attention and excite admiration.

There is a prettily-made, though soberly-coloured, little Beetle, called *Brachinus explodens*, the latter title being given to it in consequence of a most singular property which it possesses, and which is almost unique in the animal kingdom. It secretes a remarkable volatile fluid, which it has the power of retaining or expelling at will. When alarmed, it throws out a small quantity of this fluid, which immediately volatilises with a slight explosion when it comes in contact with the atmosphere, and looks very much like the fire of miniature artillery. In consequence of this phenomenon, the insect which produces it is popularly called the BOMBARDIER BEETLE.

This curious property is used in defence. The Beetle, being a small and comparatively feeble one, is liable to be attacked by the larger Geodephaga, especially by those belonging to the genus *Carabus*. The lesser insect could have no chance of escape but for its curious weapons of defence. When the *Carabus* chases the *Brachinus*, the latter waits until the former has nearly reached its prey, and then fires a gun, so to speak, in its face. The effect on the *Carabus* is ludicrous. The insect seems quite scared at such a repulse, stops, backs away from the tiny blue cloud, and allows its intended prey to reach a place of safety.

The illustration represents this scene. The pursuing Beetle, *Carabus monilis*, is chasing the Bombardier, and has very nearly captured it, but is stopped by a discharge of artillery, under cover of which the Bombardier will make off. Meanwhile, the *Carabus*, exchanging its rapid advance for a retreat nearly as rapid, throws its antennæ backwards—a movement which is analogous to that of a dog when it drops its tail between its legs—and, before it can recover itself, its intended prey has made good its escape.

The Brachini may be identified by the very convex body, and their palpi without the securiform terminal joint. The Bombardier Beetle is reddish-yellow, with dull deep-blue elytra. It is, however, a variable species, as are all, or nearly all, of those in which green or blue is the prevailing colour, and, though most specimens are blue, or blue-black, some are deep blackish-green. It also varies greatly in size, some specimens being not a quarter of an inch in length, and others more than the third of an inch long.

These Beetles love wet situations, especially when the water is brackish, and hide under stones and in crevices, so that they are seldom seen except by insect hunters. The banks of tidal rivers are good hunting grounds for the searchers after Brachini, such as the Thames, from Erith, or even Woolwich, to its mouth. They are found in greatest numbers below Gravesend, and ten or twelve may sometimes be seen under a single stone, firing off their artillery when deprived of their shelter.

The volatile fluid which produces such curious effects is secreted in a little sac just within the end of the abdomen. It is not only capable of repelling the larger Beetles by its explosion and cloud of blue vapour, but is potent enough to discolour the human skin when discharged against it, as many have found who have captured Bombardier Beetles by hand. Should it get within the eyelids, the pain and irritation produced resemble those which would be caused by a corresponding amount of the strongest vinegar.

The whole of the contents are not ejected at one discharge, but there is sufficient to produce a series of explosions, each perceptibly fainter than its predecessor. Even after the death of the Beetle, the explosions may be produced by pressing the abdomen between the finger and thumb. Even in our small British species the phenomenon is very surprising, but there are much larger species in hotter countries, which produce much louder explosions, accompanied with quite a cloud of vapour. Two British species of *Brachinus* are known to entomologists.

WE come now to another family of Geodephaga, of which we can but take one example. The Scaritidæ, like the preceding family, are seldom seen in the open air, but, instead of

creeping into clefts already existing, they make tunnels for themselves. Tunnelling Beetles are almost invariably cylindric in shape, and this is the case with the Scaritidæ. The thorax of these Beetles is rather peculiarly shaped, being separated from the abdomen by a sort of neck, or 'pedunculated,' if we use the scientific term. The tibiæ of the first pair of legs, which are the tools chiefly used in burrowing, are very hard, very strong, and boldly toothed, and the antennæ are short, and have scarcely any distinction between the joints.

One of the best examples of the Scaritidæ is shown on Woodcut II. Fig. 4, and is an insect called *Clivina fossor*. The length of this Beetle is rather more than a quarter of an inch. Its colour is exceedingly variable, ranging from pitchy-black to chestnut, brown, or even brick-red. This variation in colour depends chiefly upon the exposure to the air, the oldest specimens being the darkest. This gradual darkening by exposure to light is very frequent among insects; and a too familiar example may be found in the common cockroach, which is often seen almost white, darkening gradually until it assumes its well-known red-brown hue. There are only two British examples of this genus.

Usually, the *Clivina* is found under stones and in heaps of decaying vegetable matter, but I have taken great numbers out of a large rotten log, which was seen to be full of their burrows as soon as the bark was removed. I took out of the same log both the larvæ and pupæ of the same Beetle, having nothing to do but to break up the soft and rotten wood with a powerful digger, previously laying a newspaper below the log. The insects fell out in numbers without being injured, and could be taken in any number.

The instrument which is here mentioned was not of the usual form, but was made to order, and a very useful article it was. It was shaped something like a mattock, the blade being trowel-shaped and slightly curved, and a broad hammer taking the place of the prongs. The blade was very strong and sharp-edged, and on occasion could serve as an axe, while the hammer end was useful for breaking up the hardened earth in which many Beetles reside. It was particularly useful during hard frosts, because the Beetles are then in their winter quarters, and cannot be got at without some such weapon. If I were

to have another digger made, I should have the handle prolonged into a sort of crow-bar with a rather sharp edge, so as to be able to use it as chisel and lever united.

When the insects are captured, the next business is to know how to deal with them. There is not the least difficulty with soft-bodied moths or butterflies, as they can be easily killed when caught; but the hard-bodied Beetles are not so easily deprived of life, and a great number of them will fight if placed in the same vessel, and eat, or at least mutilate, each other. There is nothing better for such insects, or rather for their capturer, than the 'laurel-bottle.' This is very easily made. Take a wide-mouthed bottle, and fit a cork very firmly into it. Bore a hole through the cork, and insert in the hole a swan-quill or short metal tube about two inches long, so that it may project at least half an inch through the cork into the bottle. The upper end should be stopped with a cork, and it will be better to cut the cork so long that it can be removed by holding it between the teeth. I always cut the upper part of the tube slopingly, so that a very small Beetle can be scooped up with it.

For many Beetles nothing more is requisite, except to put a piece of crumpled rag at the bottom, so as to give them a foothold; but for the fiercer and voracious Adepaga an additional precaution is required, and they must be killed as soon as they are put into the bottle, or an undisfigured specimen will never be obtained.

If a bottle can be obtained without any neck, the following is the neatest way of making a laurel-bottle:—Cut a flat cork that fits rather tightly in the bottle, but not too tightly to be pushed up and down. Take out a portion of its middle, and insert a piece of fine wire gauze. It will be better to pass a string through each side of the 'plug,' as we will call this cork, and knot them underneath, so that when the plug is to be withdrawn it can be pulled up by the strings.

Next, procure a handful of the young buds and leaves of laurel, put them into the bottle, and crush them into a paste with the handle of a knife or some such instrument. Now insert the plug, press it down upon the crushed leaves, put in the cork, and the 'laurel-bottle' is complete. If the bottle should have a neck, make a small gauze bag, tie up the

crushed laurel in it, and put it into the bottle. In either case, the bottle must be kept firmly corked, or the vapour will escape.

The use of the bottle will be shown as soon as it is employed. Let a Beetle, however large, fierce, or voracious, be put into it, and its fate is at once sealed. It begins to kick and struggle, as if it knew its danger; but in less than a second the struggling is evidently over, and the insect turns on its back, with its legs quivering in the poisoned air. The fact is, the laurel contains a large amount of prussic acid, and the interior of the bottle is charged with its vapour. Now, as has already been mentioned, the breathing apparatus of an insect pervades the whole of the body, even to the end of the limbs; and when the poisonous vapour is inhaled, it penetrates simultaneously the entire system, and causes almost instantaneous death. It will be as well for the beginner to use the laurel-bottle for all Beetles, as it does not damage them, and he need not trouble himself to distinguish the voracious from the harmless species.

There is only one drawback to the laurel-bottle, and this is more apparent than real. It stiffens the limbs, so that the insects cannot be 'set' properly, and the legs will rather break than bend. However, this difficulty is overcome in a very simple way—namely, by leaving them in the bottle for a few days, when the rigid limbs will become relaxed and as flexible as they were during life. Some care, however, is required, as, if they are left too long in the bottle, the process of softening extends too far, and the limbs are apt to fall off altogether.

Very few instruments are required for the capture of Beetles besides the digger which has already been described. Two nets are almost indispensable, one made of stout net, and the other of brown holland or the strongest linen. The former should be about seven inches in diameter, and is used for fishing Water Beetles and their larvæ out of ponds, ditches, and streams.

The latter, which is called from its use the sweep-net, requires to be made with some care, as it meets with very rough usage, and, unless properly made, will soon be worn out. The depth should be at least twice its diameter.

The framework of the net is simply a ring or hoop about nine inches in diameter, made of iron or brass about as thick

as an ordinary quill. If it be of lighter material, it will not endure the rough work for which it is made. The ring is covered loosely with the strongest tape, and to the tape is sewn the net itself, which is nothing more than a bag of holland or linen. The best sweep-nets have a number of small rings soldered on the inside of the hoop. A stout wire is run through the rings, and the net is made fast to the wire. By this plan the net will outlast twenty nets made in the ordinary way. The angles at the bottom of the net should be carefully rounded off.

Now for the mode of using it. The simplest plan is to attach to the ring a strong screw which fits into a ferrule at the end of a stout walking-stick. The entomologist can, therefore, go about his task without betraying any signs of his occupation. The sweep-net and water-net, folded round their rings, are placed in one pocket, the laurel-bottle is in another ; the digger is hidden under the skirts of the coat, and a pair of curved forceps is in the waistcoat pocket.

When a promising sweeping-place is found, such as a hedge-row, some long grass, fern or heather, a quantity of nettles, a turnip field, or any such locality, the sweep-net is screwed to the walking-stick, the laurel-bottle hung by a string to a button, and all is ready. The net is then swept at random backwards and forwards among the herbage, the stroke always having an upward direction. This, with a little practice, can be done so rapidly as scarcely to impede the walk. It is better, however, only to sweep one kind of plant at a time, so as to be sure of the particular herb or vegetable frequented by each species.

After a time, comes the examination of the net. Lay it flat on the ground, doubling it over, so that the pressure of the hoop prevents the inmates from escaping. Now, draw it through the hoop very slowly, taking care that none of the more active Beetles make their escape, especially those which hop and fly ; seize the insects as they make their appearance, and drop them into the laurel-bottle, always replacing the cork. Most Beetles—and, in fact, nearly all that are taken in the sweep-net—will pass through the tube ; but the large Ground Beetles, some of the Water Beetles and chafers, and one or two others, require to have the large cork removed.

On returning home, the entomologist should take out the cork from the laurel-bottle, and empty the insects into some boiling water, as some of the species have the strongest objection to die, and, after they have been apparently killed, have a habit of reviving in a manner that is rather startling to the young entomologist. It is no uncommon thing for an insect-hunter to capture a number of Beetles, set them, put them away in the 'setting-box,' and then, after a week or so, to find three or four of them kicking about and doing their best to escape. Some of the *Geodephaga* have been known to drag the pin from the board, and, though still impaled, to devour their fellow sufferers.

Ordinary Beetles can be taken by hand, but for the very small species the forceps is used. This instrument should be of good length. The regular dealers offer for sale a brass forceps about two inches in length. This is nearly useless. Get the forceps of steel, at least four inches long, and made with a curve. The curved forceps is just as useful as the straight instrument for picking up a Beetle from the ground, while it can be inserted into crevices which the straight forceps could not enter.

'Setting' Beetles is not a difficult matter. For moderately-sized Beetles the following plan answers perfectly. Take a fine pin, such as are sold for the purpose, and pass it through the disc of the right elytron, and so fix the Beetle on a board. Now draw out its legs, and place them in their natural position, fixing them, if required, with pins and little bits of card-board. Treat the antennæ and palpi in the same way, and nothing more is needed.

Very small Beetles should be fixed on white card-board with coaguline. If the cement be well thinned, there will be plenty of time to fix the legs and antennæ before it sets. Only one Beetle should be set on one piece of card. In all cases, if the Beetle have wings, and several specimens can be procured, one of them should be set with the wings expanded as in flight; and, when card is used, one specimen should be laid on its back, so that the structure of the mouth can be examined. Should a more detailed examination be required, nothing is easier than to damp the card-board, remove the insect, and replace it after its structure has been investigated.

For examining the details of a Beetle, especially if it be a small one, a pocket lens is required. These instruments are made with either two or three glasses, and are small enough to be suspended to the watch-chain by a ring. In order to examine a Beetle with ease, the pin should be stuck into a cork cemented on a flat piece of lead, so that it cannot be knocked over. My own instrument is made of a champagne cork, cut into a cylindrical form and rounded on the top. I prefer the champagne cork for two reasons—the first being that it is of an uniform and close texture, without the holes and hard spots which are found in ordinary corks, and the second being that it has not been pierced with the corkscrew.

ONLY one other English genus belongs to this family, namely, the genus *Dyschirius*. All its members are very brilliant, very active, and very small, the largest being barely one-sixth of an inch in length. Small as they are, they are as ferocious as the Tiger Beetles, and are most persevering in their chase of prey, which mostly consists of Beetles belonging to the *Brachelytra*. There are several Beetles belonging to the genus *Bledius* or *Hesperophilus*, which inhabit the sandy shores, and live in small burrows which they make in the sand just above high-water mark. On these little insects the *Dyschirii* feed, chasing them through their tunnels just as weasels chase rats.

All these Beetles are cylindrical, and their surface has a sort of brassy polish. The mandibles are stout, very sharp, and toothed at the base. The antennæ are slender, with the second joint the longest, and the thorax is globular.

CHAPTER III.

GEODEPHAGA—continued.

WE now come to the important family of the Carabidæ, to which belong some of the largest and most powerful of the Geodephaga. The Carabidæ are in many points exactly like the Cicindelidæ, and if isolated parts of the mouth were taken to an entomologist, he would have some difficulty in knowing to which family they belonged. But, whereas the Cicindelidæ have a notch on the inner side of the front tibiæ, these limbs are without the notch in the Carabidæ.

The typical genus is well represented in this country, and its members are familiar to us by the title of Ground Beetles or Garden Beetles. They are the largest of the family, some of them being an inch in length, and strongly though elegantly shaped. They are very active, as far as their legs go, but they have no wings, these members being only found in a rudimentary state under the hard and shining elytra, which in most of the species are soldered together and cannot be opened. In one species, however, *Carabus granulatus*, the elytra are capable of motion, and the wings are more developed than is generally the case. They are, however, much too small to be used for flight. The mandibles have a small tooth in the middle, and the labial palpi have the last joint securiform, or axe-shaped. The thorax is somewhat heart-shaped, and has the posterior angles boldly marked. In the male the tarsi of the first pair of legs are broader than in the female.

Thirteen British species of *Carabus* are known, one of which is represented on Plate I. Fig. *b*, in the act of chasing the *Brachinus*. It is the *Carabus monilis*, a common and very handsome insect. It is exceedingly variable in colour, and slightly so in marking, but may be described as follows:—The head is black, with bronze or green reflections, wrinkled in front,

and there is a deep hollow on each side just between the antennæ. The thorax is wrinkled at the hinder angles and deeply notched behind, and its colour is deep copper. The elytra are metallic green or violet, and sometimes entirely green. Each elytron is marked with three rows of raised striæ, broken regularly at intervals, or 'interrupted,' to use the scientific term, and between them are three ridges which are not broken. The line along the suture is black, and the under side of the insect is dull black.

This Beetle is common in gardens, and, like the rest of its kin, ought to be encouraged and protected, as it feeds almost entirely on the smaller insects, and never meddles with the vegetables. One of the species, *Carabus auratus*, which is plentiful in France, though very scarce in this country, is most useful to the farmer, as it watches for the female cockchafers as they descend to deposit their eggs in the ground, and then kills and eats them, thus doing more good than if it fed on the destructive grub itself.

It can be found in the daytime by lifting stones, flower-pots, logs of wood, dead leaves, or similar objects that have been lying in one place for some little time. Care must be taken in handling it, as all the Carabi have an unpleasant habit of pouring from their mouths a blackish fluid which stains the fingers, and is of a very disagreeable character. It is said that the insect can project this fluid to some distance; but I have never seen this done, though I have caught great numbers of Carabi, and given them every provocation to make use of this weapon, which is analogous to the explosion of the *Brachinus*.

All the Carabidæ are beautiful insects, and it is difficult to select any one that is pre-eminent beyond its fellows. Personally, I think that *Carabus cancellatus* carries off the palm, though it is not so large as several of its congeners. Its shape is peculiarly elegant, and its colour is greenish brass, or coppery, sometimes deepening into black. On each of the elytra are three chain-like marks composed of oblong tubercles placed end to end, and between each of them is a single bold ridge. These marks are similar in character to those of the preceding insect, but they are very much larger and bolder, and can easily be distinguished without the aid of a lens. There are the rudiments of wings to be seen under the elytra. In

PLATE II.
GROUND BEETLES.

1. *Lebia crux-minor*.
2. *Calosoma inquisitor*
3. *Carabus intricatus*.
4. *Cychrus rostratus*.
5. *Calosoma*, larva in nest of Social caterpillar.
6. *Carabus*, larva.

PLANTS :—

Trunk and branch of Oak (*Quercus Robur*). Above.
Wood Anemone (*Anemone nemorosa*). Across Centre.
Cowslip (*Primula veris*). In Middle.





the spring time this insect may be taken in decaying willow-trees.

Another species of this genus, *Carabus intricatus*, may be seen on Plate II. Fig. 2, where it is represented as ascending the trunk of an oak-tree in search of prey. If any of my readers should happen to see the insect itself, he will be the envy of all brother entomologists, inasmuch as it is not only a singularly handsome but a very scarce insect. It is the largest British Carabus yet known, and is finely marked and coloured. The head is black, with a violet gloss, and has a deep impression on either side. The thorax is of the deepest violet or green, becoming black on the margin, and is wrinkled over its entire surface. The elytra are very deep and shining-violet, and on each elytron there are three rows of elevated tubercles of an olive-green, the remainder of the surface being wrinkled. The under surface of the body is black, glossed with violet.

At Fig. 6, in the left-hand lower corner of the same plate, is seen the larva of a Carabus. These larvæ are, like the perfect insects, carnivorous. They are armed with powerful jaws, having a strong tooth near the base. The antennæ and maxillary palpi have each four joints, and there are six ocelli, or simple eyes, on each side. At the end of the tail are two horny spines, each armed with a sort of spur.

The last species which will be described is the *Carabus violaceus*, one of the commonest and largest of the species. It sometimes exceeds an inch in length. Its colour is rather remarkable. At first sight it appears to be a black insect, but a more careful examination shows that the supposed black is in reality the deepest violet, which on the margins of the elytra and thorax becomes of a rich burnished golden-violet, like as of polished metal. The whole of the upper surface is granulated, the elytra more deeply than the thorax, along the centre of which there is a slightly elevated line. Below, it is black, with a slight green or blue reflection. Altogether there are thirteen British Carabi.

These Beetles afford good practice in setting. They are large enough to bear handling, and yet small enough to require care. Their legs are long, and look well when set out, and the parts of the mouth are sufficiently large to show whether the operator has been careful about his work. Their only

drawback is the lack of wings, but it is more than compensated by the other advantages. These Beetles, by the way, are very tenacious of life, and, though they can be at least rendered insensible and harmless by the laurel-bottle, it will be as well to dip them into boiling water before passing the pin through them, so as to avoid the sight of an impaled Beetle trying to release itself, or walking about the cabinet drawer with a pin through its body.

I have always had a great liking for these Beetles, from the time when I was accustomed to harness them into fairy chariots, to that in which I first learned from them the wonders of an insect's organisation, and traced in them the early rudiments of those structures which find their fullest development in man.

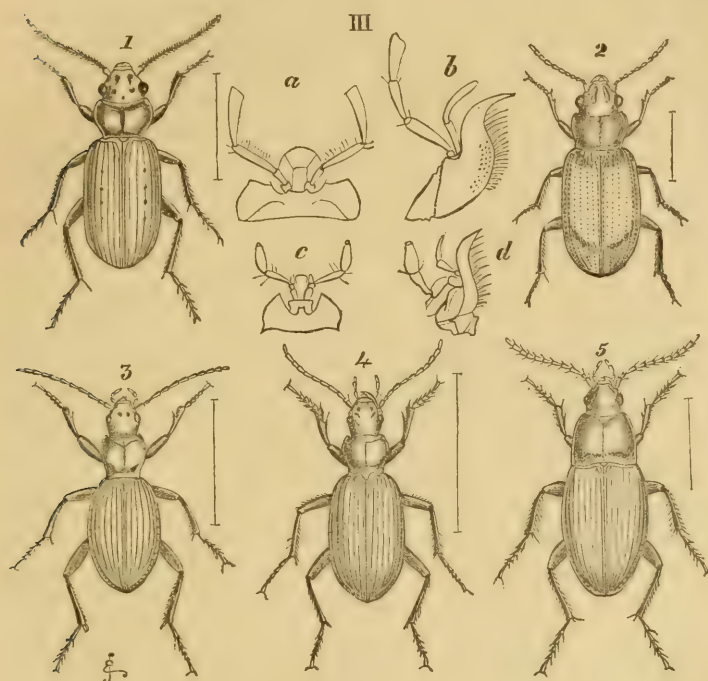
NEXT on our list comes the genus *Notiophilus*, which, being translated, signifies wet-lover, and is a very appropriate title. All these Beetles are very small, none of them exceeding a quarter of an inch in length. They may be found on the banks of ponds and streams, running over the wet soil with great activity in search of prey. In consequence of their fondness for water they were for a long time classed among the Hydradephaga, or the voracious Beetles of the water, but have now been placed in their right position among the Carabidæ.

On Woodcut No. II. Fig. 5, is a magnified figure of a common species of this genus, called *Notiophilus biguttatus*. It is a very small Beetle, sometimes only one-sixth of an inch in length, and seldom, if ever, exceeding a quarter of an inch. It is a pretty little creature, with a highly polished surface, as if made of bronze in which the copper predominated. Five species of this genus are known to inhabit England, and they may be found hidden under stones or at the roots of trees in damp places. Willow-trees on the borders of streams are good localities for these pretty little Beetles. They do not, however, confine themselves to wet places, although they prefer such places as a residence. They may be seen running about in the hottest weather over places a mile at least from water.

The maxillary palpi of this genus have the last joint rather egg-shaped, and sharply cut off at the end, as may be seen by reference to Woodcut II. Fig. e, which represents the left labial

palpus of this insect. The antennæ are slender, and rather thicker at the tip than at the base. The head has a deep furrow between the eyes, and the elytra are long and flattened.

ANOTHER genus now comes before us, our example of which is *Nebria brevicollis*, a figure of which is given on Woodcut III. Fig. 1. These are larger insects than those of the preceding



1. *Nebria brevicollis*. 2. *Pogonus luridipennis*. 3. *Pristonychus terricola*. 4. *Sphodrus leucocephalus*. 5. *Calathus cisteloides*. a. *Nebria*, labial palpi. b. *Nebria*, maxillary palpus. c. *Pogonus*, labial palpi. d. *Pogonus*, maxillary palpus.

genus, their length exceeding half an inch, and sometimes reaching three-quarters of an inch. In these insects the antennæ are long and slender, and the mentum is divided into three distinct lobes, the central lobe being cleft, as it were, into two. The thorax is heart-shaped and abruptly cut off both in front and behind, the basal angle being straight. The wings are well developed. Most of these Beetles belong to the maritime insects.

The present species is called by the name *brevicollis*, in consequence of its short neck. The head, thorax, and elytra are black, and the antennæ, palpi, tibiæ, and tarsi are dull, pitchy-red. The elytra have their surface marked with bold striæ, which are thickly punctured, and have several large pits on the third stria from the suture. Although plentiful enough when insect-hunters know where to look for them, the *Nebrias* are not often found, owing to their habit of concealing themselves in the crevices of sea-side rocks, so that it is necessary to break open the rocks in order to dislodge the Beetles. The digger mentioned on page 25 will be found very useful for this purpose. The Beetles prefer the sandstone rocks to the chalk cliffs for their residence. The length of this species is one-third of an inch. The peculiarly-formed labial palpi of this genus can be seen by reference to Woodcut No. II. Fig. *a*, and the maxillary palpi at Fig. *b*. Four species of *Nebria* are known to inhabit England.

If the reader will refer to Plate II. Fig. 2, he will see represented an episode in insect life which is not common in England, where the insect is scarce, though sufficiently so on the Continent, where it is plentiful. It seems very strange that so narrow a strip of sea should separate so many insects from us, especially as vessels are continually passing backwards and forwards. It is a fact, however, that many of our very rarest insects are quite common on the opposite coasts of France, where they live under exactly similar conditions as those of our own island. I cannot but think that, in cases where the insect is, as in the present instance, an extremely useful one, any entomologist would be doing a patriotic act by bringing over a number of them and turning them out to get their living in England.

There is no difficulty in distinguishing the genus *Calosoma* from *Carabus*. The body and thorax are much more globose and rounded, the third joint of the antennæ is flattened, and well-developed wings are seen beneath the elytra.

This handsome Beetle, called scientifically *Calosoma sycophanta*, ranks among our rarest British insects, but absolutely swarms in many parts of the Continent, being so plentiful in fir-woods, that if an entomologist go out at night, after the

manner of his kind, with sugar and a lantern, the trunks of the trees appear to be quite studded with gems, which are the shining green bodies of the Calosoma.

The name Calosoma is formed from two Greek words, signifying beautiful body, and is more appropriate than the generality of insect names. The head and thorax are very deep violet, almost amounting to black, the violet being most brilliant on the margins of the thorax, which are flattened and slightly turned up like the brim of a hat. The whole surface of the thorax is finely granulated, and there is a faint but distinct groove along its centre. The elytra are singularly beautiful. They are gold-green 'shot' with blue, the hues shifting, like those of a pigeon's neck, with every change of light. They are deeply and regularly striated, and on each elytron there are three rows of rather deep punctures, placed at some distance apart. Counting from the suture, the punctures are placed on the fourth, eighth, and twelfth striæ. Although they are well marked, they cannot be properly seen without a magnifying glass, though when viewed with a side-light they look like three rows of tiny glittering points. Beneath, the insect is black, glossed with bronze. Its length is rather more than an inch.

It is impossible to calculate the benefit which this beautiful insect confers upon the countries in which it lives, and it is not too much to say that but for the Calosoma the fir-tree would be extinct in many of those places from which we derive our chief stores of timber. Both in the perfect and larval conditions it is carnivorous, feeding upon certain destructive caterpillars belonging to the Bombycidæ, among which those of the Processionary Moth (*Cnethocampa processionea*) and the Gipsy Moth (*Liparis dispar*) are the most conspicuous. It does not, however, feed only on the caterpillars of moths, but also devours the larvæ of the Pine Saw Fly (*Lophyrus pini*), thus selecting, with a curious instinct, the very creatures which do most harm to the forest. In the plate the insect is represented as looking down from the branch to which it has climbed in search of the Brown-tail Moth's nest.

Although it eats many of these larvæ after it has attained the perfect form, it commits the greatest ravages while itself in the larval condition. In this state it is ugly as it is beautiful when it becomes a Beetle. It is a black, soft-bodied grub,

something like that of the *Carabus*, flattened and scaly on the upper surface of each segment and the head. It has two large, sharp, curved, and powerful mandibles, from which no caterpillar has a chance of escape, and there are two horny spines at the end of the tail. Its length, when full-grown, is about an inch and a half.

The voracity of this larva is amazing. It will eat several caterpillars, and even pupæ, daily, and gorges itself to such an extent that the soft body becomes quite distended like that of a full-fed leech, and the creature is quite incapable of moving. In this condition it often falls a victim to its own voracity, and that in rather a curious manner. It has been mentioned that, among other insects, the Processionary Moth forms a large proportion of its food. Now the caterpillars of this moth are social in their habits, and spin large webs, in which they live together. Into these nests the larva of the *Calosoma* is sure to creep, and sometimes as many as five or six have been found in the same web, feeding on the inmates. Sometimes it happens that a *Calosoma* grub, hungry and wandering in search of food, discovers a nest of Processionary caterpillars, and straightway makes its entrance. Being very hungry, it seizes the first creature to which it comes, and sometimes catches its gorged and helpless relative, which it devours without the least compunction.

I have already mentioned that the *Calosoma* is in all probability the means of preserving the supply of fir-wood. In some years, as often happens with destructive insects, sundry pine-feeding caterpillars absolutely swarm in the forest, the insect armies being so vast that anyone walking through the forest hears the sound of their busy jaws on every side as they devour the leaves. With any tree such a visitation would be a misfortune, but with the pine-trees it is death. Ordinary trees, if stripped of their leaves, will put forth a fresh set of foliage in the succeeding year, and suffer little except being thrown back in their growth; but a pine-tree, when deprived of its leaves, has no such power, and always dies. The reader will, therefore, see how invaluable are the services rendered to man by this insect, which keeps down the numbers of the obnoxious caterpillars, and saves whole forests from destruction.

Trees that have been perishing through the attacks of caterpillars have been saved by the *Calosoma*. Some years ago,

M. Boisgérard, finding that some trees were being ravaged by the caterpillars of the Gipsy Moth, placed upon the trees several females of this Beetle, and simply left them. Next year, the caterpillars appeared as usual, but in their nests were the larvæ of the Calosoma, and in two or three years the destructive caterpillars were completely cleared off.

I should not be at all surprised if the insect could be employed in England for the same purpose. It would have plenty of food among the caterpillar armies that occasionally devastate certain localities; and, if at first it could escape the fingers of collectors, it might have a chance of becoming naturalised here, and rendering to England the services which at present it performs on the Continent. It is noteworthy that the first recorded British specimen of this splendid insect was captured at Aldborough, by Crabbe, the poet.

ANOTHER species of the same genus is found in England, and is less rare than the preceding insect. This is *Calosoma inquisitor*. It is about three-quarters of an inch in length, and, though a beautiful Beetle, is not so handsome as its larger relative. A fine specimen now before me was captured by myself in Bagley Wood, in the year 1846, at which time that happy hunting ground of entomologists was open to all who went there for entomological purposes, and did not disturb the game. It had but lately emerged from the pupal state, and I found it under a stone, where it was hiding itself until its soft elytra had gained their hardness. It was so soft, indeed, that I was almost afraid to handle it, lest its shape should be injured. However, it soon became hard and glossy, and, never having been exposed to injury, is a singularly perfect specimen. I find in the MSS. of the late Mr. Hope, which he kindly lent me, that, in the summer of 1820, several were beaten out of the foliage of oaks, and others dug from beneath the roots of the same trees in the early spring.

The colour of this Beetle is very beautiful. The head and thorax are very deep bronze-green, and finely granulated, the latter having a very deep pit on either side near the hinder angle, and its edge being very bright blue-green. The elytra are of a similar colour, and covered with striæ. Each stria is broken at short intervals with transverse lines, perceptible even

to the naked eye, and the edges are bright blue-green, like those of the thorax. There are three rows of impressions on the elytra, similar to those upon the preceding species, but not so shining. The under surface of this handsome insect is dull blue-green, and the legs and antennæ are black.

NEXT in order comes the plainly-coloured, but elegantly-shaped insect called *Cychrus rostratus*, the only British example of the genus, a figure of which is given on Plate II. Fig. 4.

The members of this genus can easily be distinguished by the long and slender head and thorax, by the very large elytra, which lap over the abdomen on either side, and by the projecting mandibles. The last-mentioned peculiarity has earned for the insect the specific title of *rostratus*, or 'beaked,' and, indeed, the mandibles, head, and thorax are so prolonged, that the insect might easily be mistaken for one of the larger weevils.

To the unassisted eye this is a very dull-coloured insect, appearing to be uniform black-brown; but when viewed through a magnifying glass, the surface of the thorax is seen to be thickly wrinkled and punctured, and that of the elytra finely granulated, so that a soft and satiny gloss is imparted to the otherwise unattractive surface. Its length is, on an average, rather more than three-quarters of an inch.

It is not reckoned among our common insects, probably on account of its habit of concealing itself in dark places, in which it may easily escape observation in consequence of its sombre colouring. It is to be found under heaps of leaves, stones, or wood-piles, such as are left by the fagot-makers. I have taken it in Wiltshire and about Oxford. This is one of the very few Coleoptera which can produce any sound, and the squeaking noise which is heard when the Beetle is handled, is thought to be produced by the friction of the elytra against the tip of the abdomen. The beautiful Musk Beetle produces a similar sound, which will be described when we come to that insect.

The larva of the *Cychrus* is something like that of *Carabus*, but shorter and broader, and the projecting spines at the end of the body are very short and without spurs. The palpi of

this genus have the last joint very large and axe-shaped. Here

may mention that nothing is easier than to examine the head and mouth of a Beetle, without doing the least injury to the specimen, even though it be hard and dry in the cabinet. Take the head between the points of the forceps, bend it gently backwards and forwards, and it will snap off. Now put it into warm water, and let it remain there until the parts are quite relaxed. Then stick a needle perpendicularly into a piece of cork, and run the eye portion into the 'occipital' hole, i.e. that at the junction of the head and thorax. With a fine needle, the parts of the mouth can be drawn out so as to be properly displayed, and, when they have been examined, the head can be replaced, and fixed, rather firmer than before, by a small drop of coaguline. This will be found a good plan when a Beetle has been badly set, and the parts of the mouth are not properly seen.

NEXT in order comes the family of the Chlæniidæ. In these Beetles the front tarsi of the males have either two or three joints much widened and squared, and very sponge-like below. On Woodcut III. Fig. 2, is given an example of this family, the insect being called *Pogonus luridipennis*. The members of this genus have the last joint of the palpi egg-shaped and rather elongated, with the tip blunt. The labial palpi are shown at Fig. *c*, and the maxillary palpi at Fig. *d*, the internal maxillary palpus being small and very slender.

They are all rather brilliant and shining Beetles, the surface of their bodies having a metallic polish. They are small and maritime in their habits, and may generally be found on the southern coasts of England, hiding under the heaps of sea-weed which are flung by the waves upon the shore.

The present species is about a quarter of an inch in length, or a little more, and is a pretty little Beetle. The head and thorax are shining green, with coppery reflections. The thorax has a longitudinal furrow along the centre, a triangular hollow in front, and a rather deep pit on the base at either side. The elytra are pale ochreous-yellow, clouded with brown in the middle, a peculiarity which has earned for the insect the specific name of *luridipennis*, or 'pale-winged.' They are covered with greenish striæ, and on the third stria are three rather

deep impressions. The body is greenish below, changing to rust-red at the tip. This species was first found on the coasts of Norfolk. Three British species of *Pogonus* are known.

ANOTHER Beetle belonging to this family is shown on Woodcut III. Fig. 3. Its name is *Pristonychus terricola*. As may be seen by reference to the illustration, it is a very prettily-shaped insect, the curves of the outline harmonising in a way that would have delighted the soul of Hogarth, had he taken the trouble to look at Nature's original of his celebrated 'line of beauty.'

Except in shape, it is not a very pleasing insect to the eye, the colour being black, with a violet gloss when examined in a proper light. The head is pitchy-black, and the thorax is sometimes of the same colour as the head, and sometimes blue-black, with a faint furrow in the centre, and a deep oblong pit on either side of the base. The elytra are of the same colour, and rather flattened, and covered with faint but regular striae, which are slightly punctured. Along the edges there is a series of roundish pits.

This Beetle is plentiful in most parts of England, and may be found in cupboards, cellars, dark outhouses, and similar localities. There is only one British species.

THERE is a Beetle, called *Sphodrus leucophthalmus*, which is closely allied to the preceding insect, and, indeed, is included in the same genus by many systematic entomologists. The reader should try to catch one of these Beetles—no very difficult matter—and look at the very long third joint of the antennæ, and the long and slender palpi. In the males, the trochanters of the hind pair of legs are developed into long spines. This Beetle is shown on Woodcut III. Fig. 4.

The colour of the insect is pitchy-black, with a slight polish. The head is smooth, oblong, and has an impression on either side. The elytra are flattish, and faintly streaked, the streaks resolving themselves under the lens into rows of small punctures. Like the preceding species, it is common in outhouses, stables, and similar localities, and is said to feed upon the cockroaches and other noisome and dark-loving insects. So, though the *Sphodrus* be not a handsome Beetle, it is worth

protection, inasmuch as it is very far preferable to the cockroach. This is the only British representative of the genus.

ON Woodcut II. Fig. 5, is represented the Beetle called *Calathus cisteloides*. The members of this genus can be known by the triangular head, the peculiarly-shaped thorax, and the elliptical elytra. The mandibles are toothed at the base. The colour of this insect is black, with a slight gloss in the male, and quite dull in the female. The triangular head has a pit on either side of the antennæ, the thorax is wrinkled on the disc, and on either side of the base is a deep impression. The elytra are rather convex and covered with shallow striæ, on which are faint punctures. The wings are undeveloped.

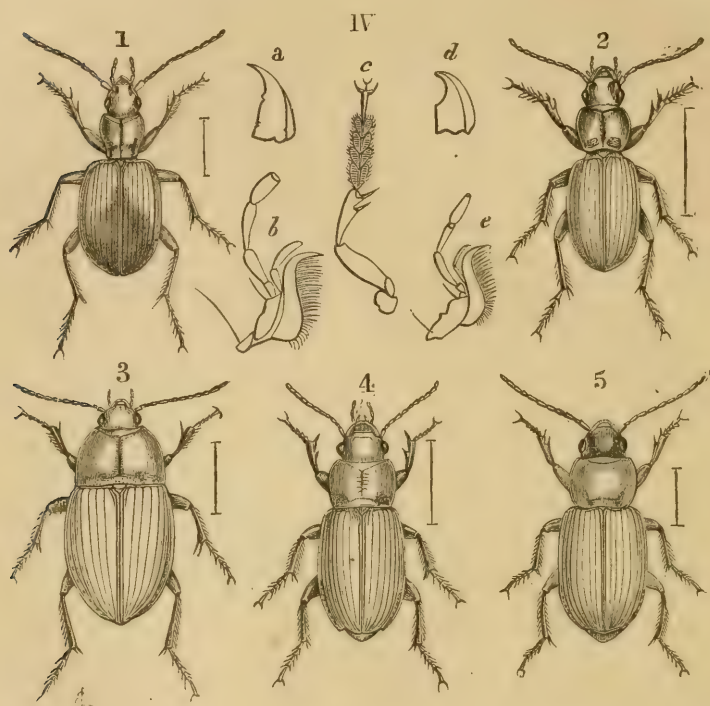
This is a very common Beetle, and is one of the wet-lovers, being generally found along the bottoms of damp hedges, under heaps of stones, and similar localities. Eight British species of *Calathus* are acknowledged by entomologists.

WE now come to the pretty little Beetles that are ranked under the generic title of *Anchomenus*. All these insects have an elongated thorax, the head egg-shaped, and the antennæ with the third joint twice as long as the second.

They are very active, and very brilliantly coloured, and, like most bright-coloured Beetles, love the sunshine, in which they dart about with exceeding rapidity. The popular name of Sun Beetle is given to these and other insects, in consequence of this peculiarity. They are sociable little creatures, and, when one is seen, others are tolerably sure to be close at hand. Some of them frequent wet and marshy places, and may generally be found at the roots of willows that are planted at the water-side.

One example of this interesting genus is *Anchomenus dorsalis*, which is shown, rather magnified, on Woodcut IV. Fig. 1. The real length of the insect can be known by reference to the line that is drawn on its right side. In this species the head and thorax are dark-green, and the flattened elytra are pale rust-red, diversified with a large spot of blue-black towards the apex, but not quite reaching the tip. They are striated, and the interstices between the striæ are flat and smooth, without any punctures. Beneath, it is shining black.

This is a very common Beetle, and is rather interesting to entomologists, because, like the *Brachinus*, it has the power of defending itself by means of mimic artillery, and can produce a number of the explosions in succession. There are more than twenty British species of this genus.



1. *Anchomenus dorsalis*. 2. *Pterostichus madidus*. 3. *Amara obsoleta*. 4. *Harpalus rufus*. 5. *Stenolophus Skrimshiranus*. a. *Pterostichus*, right mandible. b. *Pterostichus*, maxillary palpus. c. *Harpalus*, under side of leg. d. *Harpalus*, right mandible. e. *Harpalus*, maxillary palpus.

THE family of the Feroniidae, which comes next in order, comprises a number of Beetles, none of which are remarkable for beauty, though there are several whose habits are very curious and interesting. They may be known by the sinuated, or wavy, form of the elytra at the apex, and by the basal joints of the front tarsi of the males. These joints are not squared, like those of the Chlæniidae, but are somewhat heart-shaped, and furnished with two rows of bristles beneath.

Our first example of this family is the Beetle which is known to entomologists by the name of *Pterostichus madidus*, a figure of which is given on Woodcut No. IV. Fig. 2. The strong and peculiarly-formed mandible of this genus is shown at Fig. *a*, and its maxillary palpus at Fig. *b*. The colour of the insect is shining black, with a slight brassy gloss. The smooth head has two impressions in front; the thorax is convex and narrow behind, with a bold central furrow and a deep wrinkled pit at each angle. A lens is required to make out these details. The elytra are covered with regular striæ, a circumstance which has gained for these insects the generic title of *Pterostichus*, or 'streaked-wing.' There are a few small punctures on each elytron, and a row of bold punctures runs along each margin. The wings are not developed.

This is a very common insect, and can be taken in any number, as it runs boldly about. Anglers often use it successfully as bait. Although devoid of wings, it is very quick on its legs, darting about with such velocity that the generic name of *Steropus*, or 'lightning,' was once applied to it and another allied Beetle.

Twenty-two British species of this genus are now acknowledged, but in it are merged several genera of the older entomologists.

WE now come to one of the largest and most interesting insect of this family, though assuredly it is not a beautiful one. This is *Brosicus cephalotes*, a Beetle which is shown on Plate I. Fig. 4.

This insect has been called the giant of its family, a name which it well deserves, as it rivals the Carabi themselves in size, sometimes reaching nearly an inch in length. Being a predacious Beetle, it is gifted with very powerful jaws, which are attached to a head of more than ordinary size. The specific name *cephalotes* signifies large-headed, and is appropriately given to this Beetle. The generic name *Brosicus* signifies a devourer, and is equally appropriate.

This insect can at once be known by the very large head, and the shape of the thorax, which is much narrowed towards its base. A deep furrow runs along its centre, and its base has a deep pit on either side. The elytra are rounded at the

shoulder, and striated; some small punctures being scantily visible on the striae. The colour of the insect is black.

In this Beetle we see one of the fiercest and most voracious of the whole insect race. It lives on the sea-shore, generally hiding itself beneath decaying sea-weed or stones, and making burrows under such points of vantage. From this burrow it issues in search of prey, and successfully pursues all kinds of insects, its own kind included. So voracious is it, and so many insects does it kill, that if it reside for a day or two in one burrow, it can be detected by the rejected elytra, limbs, and other parts of insects which it has caught and eaten. It is the only British example of its genus.

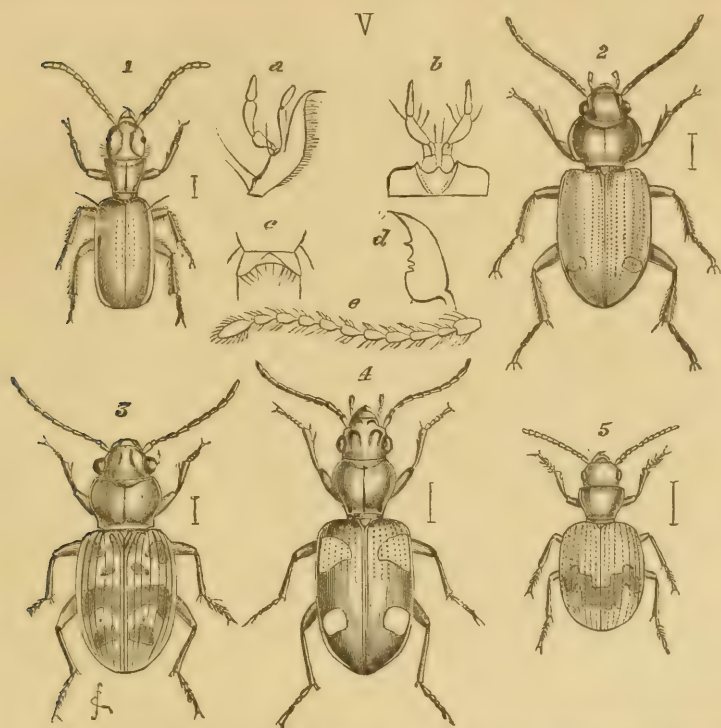
THE large genus *Amara* now comes before us, and out of the twenty-four species which are included in it I have selected *Amara obsoleta* as our example. This insect is drawn on Woodcut IV. Fig. 3. All the insects belonging to this genus are small, and most of them are brightly coloured. They all take rank as Sun Beetles or Sun Shiners; and, fortunately for them, there is a wide-spread superstition that it is unlucky to kill a Sun Beetle, and that its death will cause terrible storms.

The members of this genus are rather wide in proportion to their length, and have the thorax wide behind, as wide, in fact, as the elytra. They have large wings, which they can use with great effect; and the males have three dilated joints on the front tarsi. These Beetles are very plentiful, and may be seen either flying through the air on their ample wings, running about in the full blaze of the sunshine, or temporarily hiding under sticks and stones.

Although it is no very difficult matter to know an *Amara* when it is seen, I must warn the reader that to distinguish the different species is a task which requires the minutest attention to the smallest details, and had better be deferred until the eye has been trained to seize at once on those small but important characteristics, which at once strike the eye of a practised entomologist, and invariably elude the scrutiny of a novice. The eye can only see that which it has the power of seeing; and it is worthy of remark that twenty or thirty young observers will miss exactly the most important detail in an insect structure until it is pointed out by an experienced entomologist, when

they will at once see it, and wonder how anything so obvious could have eluded them.

In any large genus of insects there is always a difficulty in deciding upon the different species; and, even among the moths, where size and colour are tolerably constant, mistakes are continually made. But, among Beetles, these important



1. *Æpys marinus*. 2. *Philocthus biguttatus*. 3. *Notaphus* [*Bembidium*] *fumigatus*.
 4. *Bembidium quadriguttatum*. 5. *Bembidium pallidipenne*. a. *Æpys*, maxillary palpus.
 b. *Æpys*, labial palpi. c. *Æpys*, labrum. d. *Æpys*, right mandible. e. *Æpys*, antenna.

elements of size and colour go for almost nothing, and whenever green and blue are in question, colour absolutely does go for nothing. Now, in the members of the genus *Amara*, blue and green are the leading hues; and five individuals, which undoubtedly belong to the same species, may be respectively bluish-green, greenish-blue, brassy, coppery, or even black. Then the head and thorax may be of one colour, and the elytra

of another; so that no dependence can be placed upon so uncertain a characteristic.

The present species is a very common one. Its colour varies from green to black, glossed with brass. The elytra are striated, and the striæ are bolder and deeper towards the apex than at the base. The head is nearly smooth, but has a few striæ drawn across it in front.

WE next come to the large family of the Harpalidæ, of which we shall take one or two examples, illustrating the principal genera. The males of the Harpalidæ have the four basal joints of the front tarsi dilated, and sometimes the corresponding joints of the middle pair of legs. These dilated joints are covered with stiff bristles. The appearance of one of these tarsi can be seen by referring to Woodcut No. IV. Fig. c, which represents the under side of a male Harpalus's leg. The mentum is deeply notched, and has a small lobe in the centre.

Unlike the preceding family, which are for the most part lovers of light and fond of darting about in the full radiance of the sunbeams, the Harpalidæ withdraw themselves from the light, and hide themselves during the daytime in any crevice that may present itself. Should, for example, the season be a dry one, the cracks in the earth are sure to be tenanted by Harpalidæ; and when the spade is employed, many of the Beetles are turned up together with the soil in which they have sought a refuge, and sought it in vain.

On Woodcut No. IV. Fig. 4, is shown an example of the typical genus, *Harpalus æneus*. In this genus three joints of the tarsi of both the front and middle pairs of legs are dilated in the males.

The pretty species which has been chosen as our example is polished on its upper surface like a mirror, the colour being exceedingly variable. Some specimens are brassy, others coppery, others green of various shades, and others again blue of various shades, deepening into violet so dark that it appears to be black. There are some faint striæ on the elytra, and in the flat interstices between the striæ are punctures, very few towards the suture, and plentiful towards the margin. Beneath it is pitchy-black. In this insect, as indeed in most of the members of this genus, the females are much duller than their

mates, this effect being produced by a very fine granulation of the elytra. There are more than thirty known British species of this genus.

The mandible of a *Harpalus*, with its bold scoop towards the point, is shown at Fig. *d* of the same illustration, and the maxillary palpi at *e*. The species from which these specimens were taken is *Harpalus ruficornis*.

PROCEEDING with our list, we take an example of another genus, a Beetle having the somewhat strange title of *Stenolophus Skrimshiranus*. The principal mark to distinguish this genus from the preceding is that the notch of the mentum is without the lobe, which is to be seen in that of *Harpalus*. The species of this genus mostly inhabit wet and marshy places, such as under stones on the banks of ponds, ditches, and sluggish streams. The colour of this Beetle is dull reddish-brown, darkening into blackish-brown towards the apex of the elytra, which are regularly striated. There is a slight groove along the centre of the pale brick-red thorax, which has also a pit on either side of the base. The head and the under surface of the body are pitchy-black. This species is mostly found in Norfolkshire, and derives its specific name from the entomologist who sent a specimen of it to its describer, Mr. J. F. Stevens.

On Woodcut No. V. Fig. 1, is given a much enlarged figure of a very small Beetle called *Æpys marinus*, an insect which is on an average less than the twelfth of an inch in length. In this genus only the two basal joints of the front tarsi are dilated in the male insect, and they are rather triangular in shape. The fourth joint of the same tarsus is armed with a strong spine. The parts of the mouth and head are very remarkable, and are therefore drawn in the same illustration. Fig. *a* represents the maxillary palpi, and *b* the labial palpi; *c* is the labium, *d* the right mandible, showing its curious notches or dentations, and *e* the antenna.

This insect is the least of the Harpalidæ, and, partly from its small dimensions, and partly from its habits, is not often seen, except by those who intentionally look for it. It is one of the maritime Beetles, but carries its love for salt water farther than almost any other insect, inasmuch as its favourite haunt is

under stones in the mouths of tidal rivers, absolutely beneath high-water mark. There are many insects which choose their residence just above the tide-mark, but that any should prefer to live below it, and be submerged by the salt water, is indeed singular. Salt marshes are also favourite resorts for this Beetle, which has been taken in various parts of England. There is only one other species of this curious genus.

The colour of the Beetle is yellowish, darker above than below. The head has a curved impression on either side; the thorax has a short furrow on its centre, and a very shallow pit on either side near the basal angles. The elytra are very slightly punctated, and there are no wings.

WE now come to the last family of the Geodephaga, namely, the Bembidiidæ. In all these Beetles the palpi are formed differently from those of the preceding families. If the parts of the mouth be carefully observed, the last joint but one both of the maxillary and labial palpi will be seen to be very large, while the last joint is very short and very small, so small indeed that at first sight it looks more like a spur than a separate joint. All these insects are lovers of salt and wet places, and are found on salt marshes near the mouths of tidal rivers, such, for example, as those which cover the district between Rochester and Sheerness, and upon the sea-shore itself.

Small as they mostly are, one species, *Bembidium bistratum*, being the smallest of the British Geodephaga, they are exceedingly voracious, and can kill creatures much larger than themselves. There is, for example, *Gillenium laterale*, a little copper-coloured Beetle, which never exceeds one-sixth of an inch in length and is generally much less, which, in spite of its small size, feeds on the common sandhopper, seizing the active crustacean under the body, and so destroying it. Like the *Æpys*, which has already been described, this insect passes much of its time submerged under salt water.

In reference to the water-loving habits of these Beetles, Mr. Westwood gives a very useful hint to entomologists who wish to procure these tiny creatures:—‘These insects are generally found upon the margins of streams, running about with great velocity, and burying themselves in crevices in the ground or under stones, &c.; hence, at the time of high floods in winter,

the floating refuse is crowded with them, at which time the collector will not fail to obtain a rich harvest.'

OUR first example of this interesting family of Beetles is taken from the typical genus, and is called *Bembidium biguttatum*. This Beetle is by some entomologists placed in the genus *Philonthus*; but Mr. Waterhouse, whose system is followed in this work, has united several genera under the one head of *Bembidium*, in which he includes no less than forty-six species.

The insect is drawn on Woodcut No. V. Fig. 2. Its colour is brassy or bronze-green, and its surface is polished and shining. The head has a shallow impression on each side. The thorax has a slight furrow along the centre, and a depression near each basal angle. The elytra are striated and punctured nearly as far as the apex, and between the second and third striæ there are two bold impressions, from which the insect derives its specific name of *biguttatum*, or 'two-channelled.' There is a reddish-brown spot at the apex. The under surface of the body is black, glossed with brassy or bronze reflections.

ON the same woodcut, Fig. 3, is a very pretty, though very tiny, Beetle called *Bembidium (Notaphus) fumigatum*.

This little insect has the head of a deep green colour, the thorax being very black, with brassy reflections. It has a short central furrow, and a deep pit on either side near the basal angles. The colour of the elytra is exceedingly variable in different individuals. The ground here, however, is pale-brown or smoke-coloured, from which circumstance the insect derives its name of *fumigatum*, or 'smoky.' Two irregular black bands cross the elytra, and some black spots are scattered about them. A bluish line runs along the suture, and the striæ are brown.

NEXT comes an insect called *Bembidium (Lopha) quadriguttatum*, which is shown on Woodcut No. V. Fig. 4.

This very conspicuous little Beetle is tolerably common, and may be found in most damp places, whether the water be fresh or salt. The smooth head has a deep but short furrow on each side. The thorax is remarkably convex in front, and its colour is shining blue-green, or greenish-blue, as the case may be.

The elytra are rather convex, and their colour is something like that of the thorax, but deepening into violet, which is sometimes so dark that it appears to be black. On the shoulder of each elytron is a patch of cream-white, and there is another near the middle, the insect deriving from these white marks the specific title of *quadriguttatum*, or 'four-spotted.' The spot on the shoulder is usually rather triangular, and that on the middle of the elytron nearly round.

OUR last example of the Geodephaga is the pretty little insect called *Bembidium pallidipenne*, which is shown on Woodcut V. Fig. 5. The head and thorax of this species are shining metallic green. The elytra are pale yellow, or straw colour, giving to the insect its specific name of *pallidipenne*, or 'pale wing.' Across the elytra runs a zigzagged dark band, varying much in different individuals both in depth of colour, in breadth, and in shape. This species occurs chiefly on the coasts of Lancashire, though it is found in other localities.

The reader will probably understand that when a name is inserted between brackets, it is one by which the insect is known in other systems.

CHAPTER IV.

HYDRADEPHAGA.

WE have now completed our notices of the Geodephaga, the analogues of the land Carnivora among the higher animals, and we now come to the HYDRADEPHAGA, or carnivorous Beetles of the water—the whales, porpoises, and seals of the insect world.

We know that all animals are specially adapted to the life which they have to lead, and therefore may naturally expect that Beetles which live in the water will be formed very differently from those which reside on the land, even though that land be constantly wet. Shape, for example, is likely to be altered. We know that the whales, dolphins, and seals, who have to pass either the whole or the greater part of their lives in the water, and to catch in it the living prey on which they feed, become assimilated in shape to the fishes; and it is likely that insects will obey the same laws as mammals. This is really the case, the shape of all the Hydradephaga being very fish-like, in order to enable them to pass more easily through the water. As there is much more friction in passing through the water than through the air, the Water Beetles, as the Hydradephaga are familiarly called, have the various portions of the body fitting closely to each other, so as to leave an uniform smooth and polished surface, something like that of the scaly surface of the fish, the slippery skin of the whales and dolphins, and the close-set fur of the seals.

The limbs are also modified to suit the special purpose for which they are designed. As these Beetles walk less than they swim, greater provision has to be made for the latter mode of progression. Accordingly, the first and middle pairs of legs are comparatively small and feeble, the strength being thrown into the hinder pair, which are large in comparison with the

others, and, in nearly all cases, flattened and furnished with a fringe of stiff bristles on the inner side, so that they serve as oars. They are jointed in a peculiar manner to the body, so that there is room within the thorax for a set of very powerful muscles which work them, and they are placed farther back than is usual among Beetles—a peculiarity of structure which is found also in the seals and the diving birds, especially the penguin tribe.

Although they cannot, as a rule, walk well, they can all fly well, and are furnished with very large and powerful wings, so that, if food should fail them in one piece of water, they can fly to another. They generally fly at night, and have an odd way, when they reach a pond or stream, of closing their wings while high in the air, and allowing themselves to fall like stones into the water. Sometimes, deceived by the glitter in the moonshine, they have been known to fall upon the roofs of greenhouses.

Not only the Beetles, but their larvæ inhabit the water, and they are equally predacious in both stages of existence, the larva being armed with a pair of enormous sickle-shaped jaws. They are all long and narrow, and have six minute eyes, or ocelli, at each side of the head. We will now proceed to our examples of these insects.

THE Hydradephaga are divided into two families, the Dyticidæ and the Gyrinidæ. There is not the least difficulty in deciding the family to which any Water Beetle belongs, as a glance at the antennæ is sufficient for the purpose. The antennæ of the Dyticidæ are long and slender, and those of the Gyrinidæ are stout, short, and club-like. Moreover, the first pair of legs are short in the Dyticidæ and long in the Gyrinidæ. We begin with the first family, and take an example of the typical genus.

On Plate III. Figs. 1 and 2, are seen drawings of the GREAT WATER BEETLE (*Dyticus marginalis*). The first represents the male Beetle in the act of swimming, and the second the female, as she appears when flying through the air. The sexes of this and other species are so distinct that in the earlier days of entomology they were looked upon as different species. As the habits of this Beetle are almost identical with those of all its

PLATE III.
WATER BEETLES.

1. *Dyticus marginalis* (Male).
2. *Dyticus marginalis* (Female).
3. *Gyrinus natator* (and under).
4. *Dyticus marginalis*, larva.
5. *Gyrinus natator*, larva.
6. *Gyrinus natator*, Pupa case (on Arrow-head).

PLANTS :—

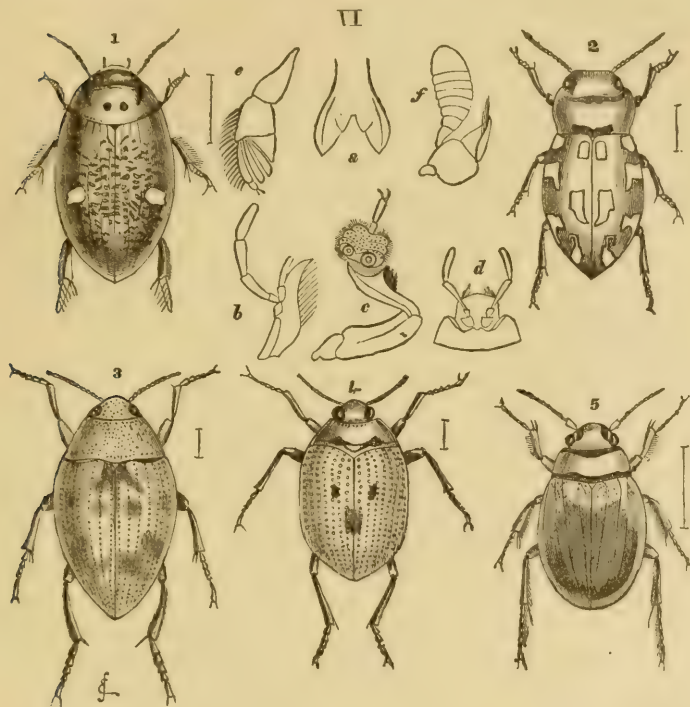
Arrow-head (*Sagittaria sagittifolia*). Left Upper Corner.
Creeping Mouse-ear (*Myosotis repens*). Right Upper Corner.
Bristle-stalk Club-rush (*Scirpus setaceus*). Under *Myosotis*.
Water Feather-foil (*Hottonia palustris*). Under Arrow-head.





family, it will be described at greater length than can be afforded to the generality of insects.

Several details which mark the Beetles of this genus are given on Woodcut No. 6. At Fig. *a* is a magnified representation of a most curious development of structure. If one of these Beetles be examined on the under side, the metasternum



1. *Agabus biguttatus*. 2. *Hydrophilus duodecim-pustulatus*. 3. *Haliphus variegatus*.
 4. *Cnemidodus caesus*. 5. *Pelobius Hermannii*. *a*. *Dyticus*, process of metasternum. *b*.
Dyticus, maxillary palpus. *c*. *Dyticus*, anterior leg of male. *d*. *Dyticus*, labial palpi.
e. *Gyrinus*, posterior leg. *f*. *Gyrinus*, antenna.

will be seen to have a forked and rather sharp projection from its centre, the points being directed to the end of the abdomen. What may be the object of this curious appendage is not easy to say; certain, however, it is, that it can be used as a weapon on some occasions.

When, for example, an unpractised entomologist catches one of these Beetles in his hand, and has taken care to keep his

fingers out of the way of its jaws, he finds himself suddenly and smartly wounded, as the Beetle struggles to regain its liberty. The fact is, the insect, led by some strange and unaccountable instinct, always retrogrades when seized in the hand, and so inflicts a rather unpleasant wound with the ends of this appendage. Whether or not it knows of the presence of the weapon, and the use to which it is put, is of course impossible to say; but that the insect can use its forked dagger as well as if it were thoroughly acquainted with it, any of my readers can easily test for himself by going to the nearest pond and catching a *Dyticus*. Other Water Beetles possess the forked appendage; but it takes different shapes in different species, and is exceedingly useful to entomologists, by enabling them to decide upon the species when other marks fail them.

This is, by the way, not the only weapon which the *Dyticidæ* possess. Like the *Carabidæ*, and some other *Geodephaga*, they exude a fluid of a singularly unpleasant smell when they are captured; but the liquid in question is white, and not black like that of the *Carabidæ*. At Fig. *b* is shown the maxilla and palpi of the *Dyticus*, and *d* are the labial palpi.

As the two sexes are so dissimilar in appearance, it will be necessary to describe them separately. The colour of the male Beetle is dim black, with the margins of the elytra marked with a yellowish streak, narrow towards the apex, and widening considerably towards and on the shoulders. It is in consequence of this streak that the Beetle has received the specific name of *marginalis*. The elytra are very smooth, with the exception of three rows of punctures on the disc. There is a reddish-yellow triangular mark on the forehead, and a very slight ridge on the crown. The thorax is blacker than the elytra, and, like them, has the margin yellow.

The legs of this Beetle are excellent examples of these limbs as they are modified in the *Hydradephaga*. Both the middle and hind pairs of legs are flattened, oar-like, and furnished with the bristle blade, and the coxa is so made that it only allows one kind of movement to the limb. In consequence of this peculiarity the *Dyticus* cannot walk properly, but only scrambles about; and if it should by chance fall on its back on a smooth surface, it spins round and round in a most ludicrous fashion.

The first pair of legs, however, are the most interesting. We have already seen that, in very many Beetles, the tarsi of the front pair of legs are dilated in the male, but there are none which even approach those of the Dyticus in complexity of structure. The geodephagous males have the under surface of these dilated joints merely furnished with a pad, but the Dyticus has a most wonderful array of suckers, exactly analogous in principle to those which stud the arms of the cuttlefish. One of these legs is shown on Woodcut No. VI. Fig. c. The three basal joints of the tarsus are enormously swollen, so that they assume a plate-like shape. Their upper surface is smooth enough, but the under surface is covered with suckers, one of them very large, and the second about half its size, and a multitude of smaller suckers. The larger suckers are placed directly upon the joint, and the others are at the end of slender footstalks, looking something like the 'patera' champagne glasses with the stems much attenuated.

In order to see this beautiful structure properly, several specimens ought to be used. One can be simply cleaned, and viewed as an opaque object, while another is cut so as to give a section of the joints, and to show the manner in which the suckers spring from them. Three more specimens should also be prepared, but mounted as transparent objects in Canada balsam. This will be found rather a difficult process, but one which will very well repay all the trouble. The difficulty is to get rid of the air which remains in the suckers, and which makes the mouth of each sucker look like a black shining ball. A structure, similar in principle, though varying in detail, is found throughout this group of Beetles.

The female is, as has been stated, very different from the male in appearance. She does not possess the wide tarsi which are so conspicuous in her mate. The elytra are very different from those of the male, and, instead of being smooth and polished, are deeply grooved nearly as far as the middle.

The voracity of this Beetle is really astonishing. It will eat almost any kind of insect, or any kind of meat, raw or cooked, preferring the former. Sometimes it is placed in fresh-water aquaria by those who are not acquainted with its powers, and the result is always disastrous. Not only will it attack every living creature in the aquarium, but during the night it

is sure to take to its wings and fly off in search of more food. Even gold fish have been attacked by this insatiate devourer, which does not even spare its own kind, and devours the opposite sex as well as its own. When these Beetles take flight from the pond or stream in which they have been living, they always crawl up a reed or a water-plant, so as to gain space to spread their beautiful wings. In consequence of this freedom of locomotion, this Beetle may be found in almost any pond, however small it may be. Even when ponds have been reduced to mere puddles by the drought of summer, the *Dyticus* may be found plentifully, hiding itself in the still soft mud.

The mode in which this insect breathes is really wonderful. Being an insect, it is forced to breathe atmospheric air, and yet it has to pass the greater part of its time under water. The problem is solved by the Beetle converting itself for the nonce into a diving bell, receiving the supply of air as often as needful. This feat is accomplished in the following way:—The body is rather flat, so that there is a space between the folded wings and the elytra. Now, these elytra are very large, and, when closed, are quite air-tight. When the Beetle wishes to breathe, it comes to the surface of the water with its head downwards, and just exposes the tip of its abdomen to the air. In a moment it has expelled the air which has already been used in breathing, and taken in a fresh supply, with which it dives to the bottom. As the spiracles, or mouths of the breathing tubes, open into the space between the elytra and the abdomen, they can take in the air, and pass it through the system. Sometimes, if the observer will approach very quietly, he may see the Beetles floating with their heads downwards, the tips of their tails just above the surface of the water, and their hind legs spread out so as to balance the body in this strange position. All the *Dyticidæ* employ this curious mode of supplying themselves with air, but it is most conspicuous in the larger species, and is therefore described in connection with this Beetle.

There is a rather remarkable point in the structure of the wings. On the inside of the elytra, and at their bases, is a pair of membranous plates with finely-fringed edges, something like wings, for which reason they have been called ‘*alulets*,’ or little wings. These cannot be seen while the insect is at rest,

but when it takes to flight, the alulets are exposed. These Beetles have the power of producing a sort of humming sound, some species louder than others, and it is generally thought that the sound is produced by means of the alulets.

Having now glanced at the history of the perfect Beetle, we will turn to its larval existence.

There is no possibility of evading the fact, that the larva of the Dyticus is ugly. It is very ugly. It is the crocodile of the insect world, lying unseen in its muddy bed, and darting out at any luckless insect that may pass near it. One of these larvæ is shown on Plate III. Fig. 4, as it appears when seizing its prey.

When full grown, this larva is two inches in length. Its colour is yellowish-brown, sometimes one tint predominating, and sometimes the other. The reader will see how this sombre-ness of hue enables it to lie concealed upon the mud as it waits for prey. At the end of its body may be seen two slender appendages fringed with hairs. These appendages communicate with the breathing tubes which pervade the body, and the larva may be observed in a position resembling that which is assumed by the perfect insect, the head downwards, and the extremity of the tail just above the surface of the water, suspended and balanced by the appendages.

The mode in which this formidable creature obtains its nourishment is very remarkable. The mandibles are, as may be seen by reference to the plate, large, sharp, and curved. When submitted to a good magnifier, they are seen to be constructed on the same principle as the fangs of a poisonous serpent, a hollow groove running throughout their length. This groove is not left open, but is closed for the greater part of its length by a membrane, an aperture being left at the base. This singular structure enables the larva first to plunge its mandibles deeply into the body of its prey, and then to suck out its juices through the hollow jaws.

As is the case with the carnivorous Beetles generally, the larva soon attains its full growth, and, when the time is at hand for its change into the helpless pupal condition, it takes itself to the bank, up which it climbs, and, burrowing into the damp earth, forms for itself a sort of round cell or cocoon, within which it assumes the pupal form. Should the change

occur in the summer, the pupa changes into a Beetle in a fortnight or a few days more, according to the warmth of the weather; but if the larva should retire within its cell in the autumn, it remains dormant during the winter, and does not appear until the following spring. As is the case with dark-coloured Beetles generally, the newly-developed insect is very light in colour and soft in texture, not assuming its hard, dark coat of mail until the expiration of some days.

There are altogether six British species of this genus.

WE now pass on to another genus, of which nineteen species are acknowledged to inhabit England, and will take, as our example, *Agabus bipunctatus*, a figure of which is given on Woodcut No. VI. Fig. 1.

It has already been mentioned that the Dyticidæ inhabit equally running or still water, and that they may be found indiscriminately in rivers and ponds. Still, some species prefer the still, and others the running waters, and the latter insects are almost always of brighter colour than the former. Such is the case with the pretty little Beetle which is now before us. The head is yellow in front, and black on the crown, with two rust-red spots, sometimes fused into one, and sometimes so faint as to be scarcely visible. The thorax is yellow, with the exception of two round black spots on the disc. These sometimes are fused together, like those of the head. The elytra are pale-yellow, diversified with small black-brown streaks, a brighter yellow spot near the middle, and a stripe of the same colour down the suture, and upon the lateral margins.

PASSING over several genera we come to a Beetle which is shown on Woodcut No. VI. Fig. 2. It is called *Hydroporus duodecim-pustulatus*, and is selected as an example of a very large genus, containing between forty and fifty species. All the Beetles of this genus have their bodies much flattened, and the tarsi of the first and middle pairs of legs with four joints, while those of the hind pair have five joints. The two first joints of the antennæ are rather longer than the others.

They are all small Beetles, and the present species is perhaps the largest of its fellows, though it is, on an average, only a quarter of an inch in length. The colour of the head is dull

reddish-brown, lighter and redder in the middle. The anterior margin of the thorax has a black stripe in the middle, while a similar stripe on the posterior margin is widened so as to form two black lobe-like marks on the thorax. The elytra are black, and on each elytron are six spots of the same colour as the middle of the head, three of the spots running parallel with the suture, and the other three being placed along the margin. Beneath, the body is yellowish.

This pretty little Beetle is exceedingly common in some places, and correspondingly rare in others. Although the spots differ much in size and shape, and in some specimens are even fused into each other, there is no difficulty in recognising the insect.

Our next example of the Hydradephaga is *Haliphus variegatus*, an insect which is shown on Woodcut No. VI. Fig. 3.

Like the last species, this is a pretty little Beetle, and exceedingly variable in its colour, so variable indeed that it has been described by the same writer under the name of at least two species. It is a very small insect, not quite one-sixth of an inch in length. Its usual colour is as follows:—The head is dark brick-red, deepening into blackish-brown on the top. The thorax is paler than the head. The elytra are rather convex, sharply pointed, deep reddish-brown in colour, and have some blackish spots near the margin. This variety is common; but there is one which is much rarer, and in this the general hue is greyish-yellow, and the whole insect altogether lighter in colour. The brightest-coloured specimens are found in rather swift streams running through a gravelly soil.

There are eleven British species belonging to this genus.

On Woodcut No. VI. Fig. 4, is shown another of these prettily-coloured but variable Water Beetles. Its name is *Cnemidotus cæsus*, and it has a vast amount of detail in its colour, in spite of its small size, which does not exceed one-sixth of an inch. The general colour of the insect is light-yellow, the head is punctated, and upon the base of the thorax is a curved, punctated impression. In order to see the markings on the elytra, or indeed to see any part of the markings properly, a good lens is required. When viewed with such assistance, the

elytra are seen to be covered with alternate stripes and dots, arranged in regular lines, of which there are two on each elytron.

This pretty little Beetle may be found in most parts of England, pools and ditches being the best localities for it. It is the only British species of its genus.

OUR last example of the Dyticidæ is that which stands last in the list. It is called *Pelobius Hermannii*, and is shown on Woodcut No. VI. Fig. 5. This is the only British specimen of its genus, which is very distinct from all the other Dyticidæ, inasmuch as there is a distinct scutellum, and all the legs are formed for walking, the hinder legs not possessing the peculiar mode of jointing which was mentioned on page 54. The body is very convex.

The colour is rather variable, but may be summed up as follows:—The hue of the Beetle is rust-red, and there is a blackish patch round the eyes. The thorax has the front and hind margins black. The convex elytra have a blackish patch in the middle, and are longitudinally wrinkled, the wrinkles converging towards the suture at the tip of the elytra. Like the preceding insect, though not very common, it is spread tolerably evenly over the country. It has the capability of producing a squeaking sound when handled.

HAVING now gone through the Dyticidæ, we come to the second family of the Hydradephaga—that of the Gyrinidæ, or Whirligig Beetles, so called on account of the manner in which they whirl themselves about on the surface of the water.

There is not the least difficulty in determining whether or not a Water Beetle belongs to the Gyrinidæ. Besides the distinctions mentioned on page 54, the peculiar antenna of a Gyrinus is shown on Woodcut No. VI. Fig. *f*, and the hinder leg at Fig. *e*, both being much magnified. Besides these points, all the Gyrinidæ appear to differ not only from the Dyticidæ, but from Beetles generally, in having, or rather in appearing to have, four compound eyes instead of two. The real fact, however, is that, in order to suit the peculiar habits of the insects, the structure of the eye is modified.

These Beetles pass the greater part of their time on the surface of the water, rowing themselves about with wonderful

velocity, and always on the look-out for prey. If the eyes were formed like those of the Dyticidæ, the water would certainly impinge against them and render the insect incapable of seeing, by reason of the drops of water which would be continually splashed over its eyes. In order to enable it to see properly above the surface, it is needful that the eyes should be placed high enough to be out of reach of the water; and to enable it to see objects in the water, it is necessary that the eyes should be submerged.

All practical entomologists are personally acquainted with this latter fact; for they know well that if they want to see objects at the bottom of the water, the only way to do so is to lie on the bank and submerge the eyes entirely. In some parts of the world fishermen use a water-telescope for the same purpose. This is nothing more than a tube, open at one end, and having a plain glass closely fitted to the other. When used, the closed end is pushed well below the surface, and the eye applied to the open end, when it is found that objects can be seen nearly as well below as above the water.

The eyes of the Whirligig Beetles are in fact water-telescopes. Instead of being placed in two masses, one on each side of the head, each is divided by the portion of the head which carries the antennæ; so that half of the eye-cluster is well out of the water, and can see objects above the surface, while the other half is submerged, and can see objects beneath it.

The COMMON WHIRLIGIG, *Gyrinus natator*, which is shown on Plate III. Fig. 3, is very gregarious in its habits, and may generally be seen in small companies, whirling about on the surface of the water in very still and sheltered places. As they dart about, they often strike against each other; but the shock does no harm to their hard and polished bodies, and they go on with their unceasing round as if nothing had happened. Their chief object in thus continually darting over the surface is to obtain food, which consists principally of small flies, Beetles, and other insects which fall into the water. They use their long fore legs in the capture of prey. They are watchful little Beetles, and if they fear danger they dive to the bottom, and there remain until they think that they can return in safety to the surface.

As in the case with the Dyticidæ, these insects are furnished

with large and powerful wings, which they can use freely ; and by the aid of which they can leave one piece of water and go to another at will, so that a newly-formed puddle is sometimes seen with several of these Beetles disporting themselves on the surface.

The life history of the *Gyrinus* is rather a curious one, and is much the same with all the species. The eggs are deposited on a water-plant, and laid in regular rows. From them, in a week or a little more, the curious larvæ are hatched. One of these larvæ is shown on Plate III. Fig. 5. It is dirty-white, in colour, and has a large, flat, oval head, armed with powerful jaws, and six rather long legs ; while from each side of the eight last joints of the body proceeds a very slender filament, which is part of the respiratory system. The last segment has two pairs of these filaments, each of which is seen, on being viewed by the aid of the microscope, to contain an air-tube, which passes into the body and there joins the general system. When in the water its appearance is very much like that of a centipede, except that the respiratory filaments have no independent motion, like the legs of the centipede, but trail loosely in the water.

In due time the larva is full-fed, and it then, as do many other aquatic creatures, leaves the water and crawls up the stem of a water-plant, until it is several inches above the surface. Having found a safe place, it spins for itself a small grey cocoon, and there waits until it has assumed its perfect state, when it breaks through the walls of the cover, and again seeks the water. One of these cocoons is shown on Plate III. Fig. 6, attached to the leaf of the Common Arrowhead (*Sagittaria sagittifolia*).

Like the *Dyticidæ*, almost all the Whirligig Beetles exude a whitish liquid of a very unpleasant odour, and are sure to do so when handled.

There are six English species of *Gyrinus*, some of which are rarer than others. The present species, which is the most common, is about a quarter of an inch in length, and blue-black in colour, with a reddish mouth. The elytra are greenish at the margins, and become narrowed towards the apex. They are very slightly striated and punctured.

A much rarer species is *Gyrinus bicolor*, which must be

sought in salt marshes and similar localities. It is much larger in proportion to its width than the preceding species, so that it can at once be detected. The most remarkable, or at least the most divergent, of the Whirligigs is the HAIRY WHIRLIGIG (*Orectochilus villosus*), which may at once be detected by the fact that the upper part of its body is black, covered with short greyish down. The body is reddish-yellow beneath, and the elytra are thickly and deeply punctated. This insect is not so fond of society as the other species, neither does it love the light of day, but hides itself in the banks of rivers and running waters during the daytime, and seeks its prey by night. In consequence of this habit it is not often seen, and even in places where it is tolerably common is sure to escape the observation of anyone who does not know how and when to look for it. It is rather a local insect, and Mr. F. W. Hope gives the Dart and rivulets on Dartmoor as a favourite locality.

The popular name Whirlwig is often substituted for Whirligig. The generic title *Orectochilus* is formed from two Greek words, signifying 'stretched-lip,' and alludes to the structure of the labrum, or upper lip, which is lengthened by a pale-coloured fringe on its edge.

CHAPTER V.

BRACHELYTRA.

THE group of Beetles which comes next in order is equally conspicuous with the Hydradephaga, but utterly unlike it or any of the groups which have been described. These Beetles are long-bodied, agile, and seem to play the same part among Coleoptera as the weasel tribe among the Mammalia. Most, though not all of them, are predatorial, and some of them, especially the larger species, are exceedingly fierce as well as voracious, and will fight any foe, no matter how much they may be overmatched.

The name *Brachelytra* is a very appropriate one, signifying short elytra. These insects have the elytra very short and squared, so short indeed that six or seven segments of the abdomen generally protrude beyond them. Although the elytra are so small, the wings are very large; and, though they must necessarily be folded in a most complicated manner before they can be packed under the elytra, these insects can take the air with more readiness than any other Beetles, except, perhaps, the Tiger Beetles, whose manner of flight has been described on page 16. In folding the wings under the elytra, the Beetle is obliged to act in a very curious manner, bending the tail over the back, and with the extremity of the body arranging the wings under their sheaths. The earwig uses its forceps for a similar purpose, as we shall see when we come to that insect. Fig. c, Woodcut No. VII., shows one of the large *Brachelytra* in the act of packing up its wings. In consequence of their activity both on the wing and on foot, these insects have gained the popular name of ROVE BEETLES.

All these Beetles have the habit of bending their bodies upwards when alarmed, for which reason they have received the popular name of Cocktail Beetles. This act has, in the

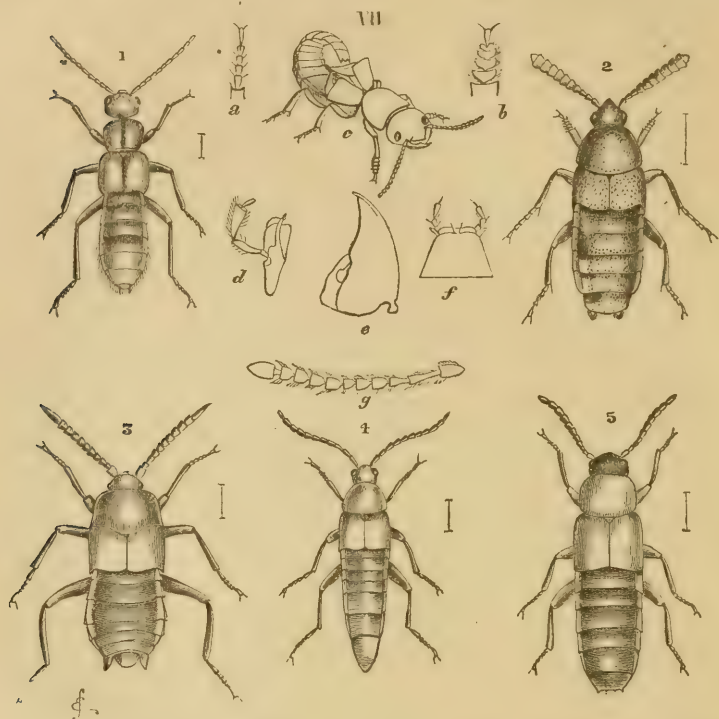
larger species, so menacing an aspect that many persons are afraid to touch so formidable an insect. In reality, the smaller species are more to be dreaded than the larger. I have already mentioned that the *Brachelytra* take easily to wing, when they may be mistaken for flies, so ample are their wings and so quick their movements. Many of them are very small—not thicker than an ordinary horsehair—and these are almost invariably the little black ‘flies’ that are in the habit of getting into the eye on fine summer evenings, and causing an amount of pain which seems quite disproportionate to the size of the insect. Of course even a small fly would cause pain if it got into the eye; but when one of these Beetles finds itself imprisoned, it instinctively turns up its pointed tail, and thus causes a double amount of irritation. I believe that, out of every ten ‘flies’ that get into the eye, seven are *Brachelytra*.

Although the larger *Brachelytra* need not be particularly dreaded, in spite of their fierce looks, it is as well not to handle them without necessity. Their bite, although sharp, is of no particular consequence; but they possess a more formidable weapon than their jaws. At the end of the tail are two tubercles, which exude a secretion of the most odious character. Like that of the skunk, it has an odour, or rather a stench, peculiarly—and fortunately so—its own, and which cannot be described by any comparison. That of the common snake, when irritated, comes, perhaps, nearer it than any other; but even that singularly unpleasant emanation is not so utterly disgusting as the effluvium of an angry Rove Beetle.

As each group of insects has certain characteristics by which its members can be identified, I will here mention some of the chief characters which mark the *Brachelytra*. The observer should first note the comparative sizes and shapes of the joints of the antennæ, palpi, and tarsi; then, let him look for the spiracles, or breathing holes, in the prothorax. Next in importance come the quantity and colour of any down that may be on the insect; while the relative width of the front tarsi will determine the sex.

THE first family is that of the *Aleocharidæ*. In this family the spiracles on the sides of the prothorax are plainly visible,

the antennæ are set close between and in front of the eyes, and the last joint of the maxillary palpi is very small and thread-like. The form of the maxillary palpus can be seen by reference to Woodcut No. VII. Fig. *d*. In this family the front tarsi of the males are not wider than those of the females, but they can be detected by looking at the last segment but one



1. *Falagria sulcata*. 2. *Aleochara fuscipes*. 3. *Ateomes emarginatus*. 4. *Oxypoda luteipennis*. 5. *Homalota brunnea*. *a*. *Staphylinus*, anterior tarsus of female, undilated. *b*. *Staphylinus*, anterior tarsus of male, dilated. *c*. *Staphylinus*, closing its wings with extremity of its tail. *d*. *Falagria*, maxillary palpus. *e*. *Falagria*, right mandible. *f*. *Falagria*, labial palpi. *g*. *Falagria*, antenna.

of the abdomen, and seeing whether it is tubercled, ridged, or has a thicker posterior margin. In such cases the insect is of the male sex.

This is in many respects a very remarkable group of insects, because in no less than eight of the genera included in it there are Beetles which are parasitic upon other insects, and which pass the whole of their lives in the nests of ants. There is

even one species that inhabits the nest of the sand martin. In the course of the following pages we shall come upon several of these curious Beetles.

Our first example of this family is *Fulagria sulcata*—it is drawn on Woodcut No. VII. Fig. 1. There are four species of this genus, which is distinguished by the large head, which is very distinct from the thorax, the first joint of the tarsus long, and the bases of the elytra without wrinkles. The structure of the antennæ can be seen by reference to Fig. *g* in the same illustration; the maxillary palpus is shown at *d*, the right mandible at *e*, and the labial palpi at *f*.

All the Beetles belonging to this genus are very small, and many of them may be captured with an ordinary butterfly-net, while on the wing. Some of the Brachelytra are so exceedingly minute that the best plan to procure them is the 'catch-em-alive-oh' principle. A few sheets of white paper should be brushed over with very pure gum-water and left to dry, when they will be useful at any time. When the entomologist wishes to capture these minute creatures, all he has to do is to choose a warm sunshiny day, damp one of these gummed sheets, and wave it about under trees until it is dry. On examining it, a number of tiny blackish specks will generally be seen, and most of these, when a lens is brought to bear on them, prove to be Brachelytra. The same paper can be used over and over again, the captured insects being removed with the point of a fine camel-hair pencil dipped in water. The species which we are now examining is shining brownish-black in colour. The thorax is rather heart-shaped, and along the centre runs a very deep furrow, reaching to the scutellum. The elytra are very wide, smooth, and slightly sunk at the base. The legs and base of the antennæ are brick-red. This specimen is a very curious one, and may be found in all parts of England, buried in fungi and decaying vegetable matter.

THE typical genus *Aleochara* has the head deeply sunk into the thorax, which is convex and broad. The elytra are broader than they are long. The abdomen has a flattened margin along the sides, and the tarsi have five joints, the basal joint of the hinder tarsi being longest. The antennæ are short, stout, and the fourth and tenth joints are of equal length.

On Woodcut VII. Fig. 2, is represented a good example of this genus, *Aleochara fuscipes*.

The colour of this Beetle is shining-black. The antennæ are short and thickened in the middle. The elytra are red, edged with black, and the legs and base of the antennæ are red, the thighs being dull-brown instead of red. This insect flies rapidly. It is a common species, and, small as it is, yet is the largest of its genus. It haunts decaying substances, whether animal or vegetable. Fifteen British species are known.

ANOTHER member of the same family, *Atemeles emarginatus*, is shown on Woodcut VII. Fig. 3, and is a rather odd-looking insect. The genus is distinguished by its broad body, and the two projections upon the last joint but one of the abdomen. The second and third joints of the antennæ are small. There are only two British species of this genus.

The general colour of this insect is shining-brown. The head is black, and the thorax has a shallow furrow along its disc. The elytra are red-brown, covered with short golden down, and the posterior angles are produced into short sharp spines.

This is one of the parasitic Beetles, residing in the nests of the bank-ant (*Formica fusca*), and a smaller species of ant (*Myrmica ruginodis*). Both these ants are very fond of their guest; and if the nest be opened, the ants take as much care of the Beetles as of their own young, picking them up in their jaws, and carrying them into a place of safety. That these Beetles do not eat either the ants, their eggs, or their young is evident from this fact; and it is thought probable by many entomologists that the Beetle discharges some secretion which is grateful to the ants, as is the case with sundry Aphides.

THE little Beetle, *Oxyptoda luteipennis*, which is represented on Woodcut VII. Fig. 4, also belongs to the same family.

The leading characteristics of this genus are as follows. The thorax is much broader behind than in front, and the head is sunk in it nearly to the eyes. The elytra have a distinct notch at the outer angle of the apex. The abdomen is strongly margined, and the tarsi have the basal joint rather larger than

the second. The antennæ are long, and slightly thickened at the tip. There are fourteen species of this genus.

The head of this species is black, and the thorax is convex, with a deep pit at the base. Its colour is dusky-black, covered with down. The elytra are dull brick-red, becoming brown at the suture; the legs are red, and the abdomen is black with red edges to all the segments. The insect is common everywhere.

THE Beetle which is our next example of this family belongs to an enormous genus, containing at least 160 species. Its name is *Homalota brunnea*, and it is drawn on Woodcut VII. Fig. 5.

In this genus the head is without any distinct neck, and the body is narrow and much flattened. The tarsi of the front legs have four joints, and those of the hind legs five joints, the four first joints being equal in size. The joints of the antennæ are bead-like.

The present species is a flat, shining, brick-red insect, with the exception of the head and the last segment but one of the abdomen, which are grey-black, the abdomen being thickly and rather deeply punctured. There is a very shallow groove in the middle of the thorax. The legs are pale reddish-brown.

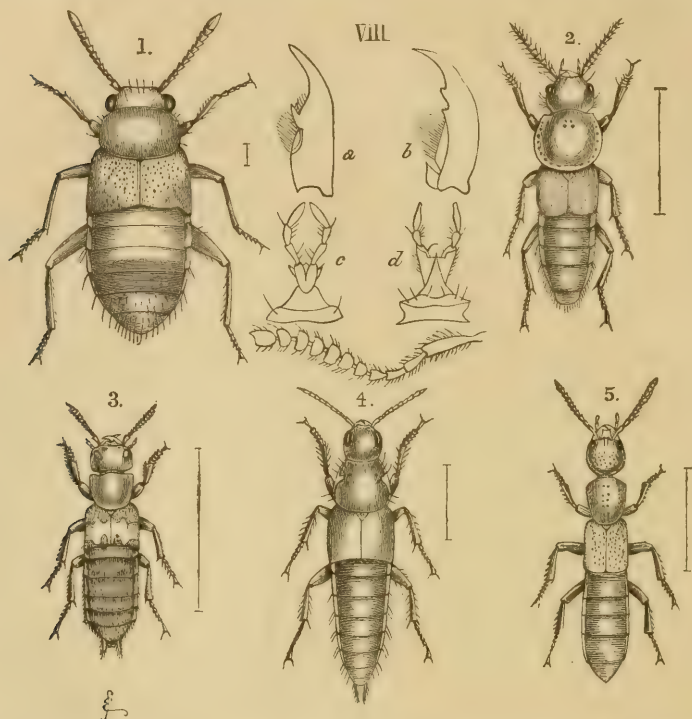
This is a very common insect, and yet Mr. E. A. Smith, who has long given much attention to the Brachelytra, tells me that he cannot fix upon any special locality for it, having found it indifferently in sand-pits, on palings, and similar places. Indeed, the whole family is a very bewildering and troublesome one to the investigator, and would require the uninterrupted labour of several years before it could be thoroughly mastered.

OUR last example of this large family is the Beetle called *Gyrophæna gentilis*, which is drawn on Woodcut VIII. Fig. 1.

The Beetles of this genus are broad in proportion to their length, and much flattened; yet, in spite of their short bodies, they are able to double, or rather roll, themselves up until they look like anything but insects, and are difficult of detection. The thorax is wider than the head and very short, and the elytra are wider than they are long. The anterior

tarsi have only four joints, and the posterior five joints, the latter having the basal joint longer than the others.

The species is dusky-red, with a tinge of yellow, with the exception of the head and a belt on the abdomen, which are pitchy-black. The thorax has a definite margin, and is thickly punctured. The legs are paler than the body. It is found on



1. *Gyrophæna gentilis*. 2. *Quedius dilatatus*. 3. *Creophilus maxillosus*. 4. *Philonthus marginatus*. 5. *Xantholinus glabratus*. a. *Philonthus*, right mandible. b. *Quedius*, right mandible. c. *Philonthus*, labial palpi. d. *Quedius*, labial palpi. e. *Philonthus*, antenna.

fungi of various kinds. There is a curious point about this insect which is worth recording. One of the very rarest of the British Brachelytra is a Beetle of the same family, called *Myrmedonia Haworthi*, one of the parasitic Beetles. When the *Gyrophæna gentilis* is placed under the magnifier, so as to enlarge it to the size of the *Myrmedonia*, the two Beetles are almost exactly alike.

THE family of the Tachyporidæ comes next in order. These Beetles have the head usually sunk deeply in the thorax, without any distinct neck. The spiracles of the prothorax are conspicuous, and the antennæ are before the eyes, on the margin of the forehead. The males have the basal joints of the tarsi dilated. All these Beetles are unrivalled for their speed, and in consequence of this characteristic the name of *Tachyporidæ*, or ‘swift-footed,’ has been given to them.

Among these insects will be found the most troublesome examples of that telescopic shutting up of the body which has already been mentioned. Mr. E. C. Rye recommends the following plan for preserving the proper shape of the Beetle:— ‘The best way in mounting them is to put gum arabic, with which a little sugar has been melted, under the tail; and, as soon as that is dry, gum the entire last segment over with tragacanth, keeping the abdomen from contracting (if you can) with a card brace. They should *not* be dried quickly.’ Some of these insects are so troublesome in this respect, that the only plan of getting them back into shape is to fix the last segment of the body to the card with a tiny drop of coaguline or diamond cement, which soon sets. Then, when it is sufficiently hardened, take the front part of the body in the forceps, and draw it gently forward until the segments of the abdomen have been pulled out to their proper extent. Then put a small drop of coaguline under the thorax, press it down with a card brace, and keep it down until it is dry.

OUR first example of this family is a Beetle called *Boletobius atricapillus*, which is shown on Plate IV. Fig. 1, two specimens being drawn as crawling on the top of a mushroom, and the other in flight. The insects of this genus live in fungi of different kinds, on which account they are called by the name of *Boletobius*, or ‘fungus-inhabiting.’ Others are seen as they appear when running in and out of the gills of a mushroom. In this genus, which contains eight species, the body narrows to a point behind, the head is long, the palpi slender, and the antennæ are long in proportion to the size of the insect.

The general colour of this species is glossy-red and shining. The head, breast, scutellum, and tip of the abdomen are black, and the elytra are blue-black with a cream-white curved mark

on the shoulder, and a line of the same colour upon the posterior margin. The antennæ are rather curiously coloured, the four first joints being black, the next five pale-red, and the last black, like those of the base.

It is a very common insect, and may be found in fungi in the autumn. Indeed, in consequence of their fungi-loving habits, all these Beetles are to be found towards the close of the year. As this is a common species, the reader is recommended to try his hand at setting it in the way above-mentioned. Even if three or four be spoiled, plenty more can be procured, and the practice will be invaluable when insects of greater rarity have to be set. None of the Tachyporidæ are large, and though most of them frequent fungi, many are found under leaf-heaps, in bones, and similar localities.

THE reader will experience no difficulty in identifying the curious Beetle drawn on Woodcut No. VIII. Fig. 2, *when he finds it*; for, in the first place, he will find no other Beetle in the same locality, and in the next place, its serrated antennæ and round and shield-like thorax will at once point it out to him. The name of this Beetle is *Quedius* [*Velleius*] *dilatatus*.

There are more than twenty species of this genus, which may be known by the shield-like thorax. Some of them are exceedingly variable; one of them, *Quedius fulgidus*, having been called by no less than thirteen names. The present species is broad and black, with a beautiful iridescence on the abdomen, and, although so sombrely coloured, is a great acquisition to the cabinet. Formerly it was the rarest of the rare among British Beetles, and even now is one of the greatest treasures that an entomologist can possess; but, now that its locality is known, it may perhaps oftener find a place in our cabinets. The secret of its rarity is that it is one of the parasitic Brachelytra, and lives in the nest of the hornet. Mr. F. Smith, who has paid so much attention to this subject, thinks that the larva of the *Quedius* feeds upon that of the hornet, and mentions that he has found in a hornet's nest a considerable number of dead larvæ, which he believed to be those of the *Quedius*. Up to the present time, 1871, he has not found a specimen of the Beetle, though he has opened very many hornets' nests. We may call it the HORNET BEETLE.

Even now that the locality of this Beetle is known, to secure a specimen is no easy matter. In the first place, it is a very exceptional piece of good fortune to find a hornets' nest that contains a *Quedius dilatatus*, as I can testify from personal experience, having seen plenty of hornets' nests and never seen a living specimen of this Beetle; and in the next place, a hornets' nest cannot be taken like that of the wasp. To take a wasps' nest is a very easy business, as the wasps always rest at night, and their fortress can be stormed without the least danger. But hornets have an uncomfortable plan of working by night as well as by day, so that no small risk has to be run by anyone who tries to take the nest of a hornet. Moreover, whereas wasps usually make their nests in the ground, where they can easily be dug out, hornets generally make theirs in the hollows of trees, and often at a considerable height from the ground, so that they cannot be extracted without the use of saw, mallet, and chisel. The late Mr. F. Stone, who probably had more experience with wasps and hornets than any other naturalist, told me that, if he began to cut out a hornets' nest at midnight, he never expected to finish his task until six or seven next morning, exposed the while to the attacks of hornets that had been out to collect food or material. So it is no wonder that *Quedius dilatatus* should be a valuable acquisition, even though we do know where to find it.

The Beetle, however, does not restrict itself to the hornet, but is sometimes parasitic on the caterpillar of the goat-moth. In this case, though the task of getting it out of the tree is not so dangerous as in the case when it quarters itself on the hornet, it is quite as tedious and fatiguing.

One species of this genus, *Quedius brevis*, is to be found in the nests of the wood-ant (*Formica rufa*). One of these Beetles is shown on Plate XI. The length of this insect is about half an inch, and its elytra are brick-red.

THE family of the Staphylinidæ, which comes next in order, contains the largest species of this group of Beetles, some of them reaching, or even slightly exceeding, an inch in length. They may be known by several peculiarities of structure. The antennæ are set far apart, their junction with the head being in front, within the base of the mandibles, which are large and

formidable. The maxillary palpi are slender, and the ligula small. The spiracles of the prothorax are large. The tarsi of the front feet are dilated in the males and slender in the females, and may be seen by reference to Woodcut No. VII., where Fig. *a* represents the tarsus of a female *Staphylinus*, and *b* the same joint in the male. The jaws, too, are not so powerful in the female, neither are their heads so large as in the case with the other sex.

OUR first example of the Staphylinidæ is one of the finest—in my opinion the very finest—of that family. It is called scientifically *Creophilus maxillosus*, but has, unfortunately, no popular name, probably because it is confounded in the popular mind with the common black species, which will be presently described. Its name is more appropriate and expressive than is generally the case with insect names. The word *Creophilus* is of Greek origin, and signifies ‘flesh-lover,’ while the specific title of *maxillosus* signifies ‘large-jawed.’ Both names show that those who affixed them to the insect were thoroughly acquainted with its character and form, for the Beetle is a most voracious carrion eater, and has jaws that are of enormous size in proportion to its body. The colour of this Beetle is shining-black, but it is mottled with short grey down.

In some places this Beetle is tolerably plentiful, but in others it is seldom if ever seen. It can generally be captured in the bodies of moles that have been suspended by the professional mole-catchers—and, indeed, these unfortunate moles are absolute treasure-houses for the coleopterist, as we shall see when we come to the next group of Beetles. A figure of this insect is given on Woodcut No. VIII. Fig. 3. It is the only British species of its genus, which is distinguished by having short and thickened antennæ, smooth head and thorax, and the latter rounded.

NEXT comes a Beetle belonging to the typical genus of the family, or, indeed, of the entire group. It is the RED ROVE BEETLE (*Staphylinus cesareus*), which is represented on Woodcut VII. Fig. *c*, in the act of closing its wings after flight, and on Plate IV. Fig. 3, as it appears when flying.

There is some little difficulty respecting the name of *Staphylinus*. This title is given by ancient writers to two very



PLATE IV.

ROVE BEETLES AND BURYING BEETLES.

1. *Boletobius atricapillus*.
2. *Ocypus olens* (eggs below).
3. *Staphylinus cæsareus*.
4. *Necrophorus humator*.
5. *Necrophorus vespillo*.
6. *Necrophorus mortuorum*.
7. *Choleva angustata*.
8. *Hister bimaculata*.
9. *Nitidula depressa*.
10. *Boletobius* in gills of Mushroom.
11. *Necrophorus humator*, larva.
12. *Silpha thoracica*, larva.
13. *Ocypus olens*, larva.
14. *Silpha thoracica* (on body of bird).

PLANT:—

Edible Mushroom (*Agaricus campestris*).





different objects, namely, a carrot or parsnip, and a sort of Beetle that gives out an unpleasant odour. As, however, the insect in question was said to walk about with its tail in the air, entomologists have considered that the term was applied to some of the Brachelytra, and, rightly or wrongly, the name has been accepted by entomologists of all countries. The specific name *cæsareus*, given to this insect, is in allusion to its colour, which resembles the 'clotted-blood' purple of Cæsar's imperial mantle.

There is another insect, which is found in the northern part of England, and which very much resembles this species. It is the *Staphylinus erythropterus*, or Ruddy-winged Rove Beetle, and may be distinguished by the fact that the scutellum is covered with gold-coloured hair. The Beetle is tolerably common, and in the summer-time may often be seen on the wing, when it looks something like a reddish, long-bodied bee. It is fond of settling on gravel walks which are exposed to the heat of the sunbeams, partly for the sake of the warmth, and partly because the colour of the gravel harmonises with the ruddy hue of its body.

Six species of this genus inhabit England. The genus is distinguished by having the whole of the body nearly smooth, the thorax squared, and the antennæ slender

Now comes an insect that is very familiar to us, the DEVIL'S COACH-HORSE, as it is popularly and fancifully called. Its scientific name is *Ocypus olens*, and it may be recognised by a glance at Fig. 2 on Plate IV., where it is represented in the attitude which it assumes when annoyed or when thinking itself in danger.

I really think that this is the very ugliest insect in England. It is scarcely so repulsive as the cockroach, its wonderful courage and spirit being redeeming points, but it is so very hideous, that the popular name exactly expresses its appearance. Its colour is dull, dead black, its eyes, which scarcely project from the head, have a cold, cruel look about them, and its tail, when raised menacingly like that of a scorpion, protrudes two yellow vesicles at the tip, from which emanates the horrible odour that has been already mentioned. Sometimes it finds its way into cellars and larders, if they be wholly or

partially underground; and then the servants are always much alarmed at the creature, of which they have a dread which is superstitious rather than the offspring of mere prejudice or ignorance.

As its appearance suggests, it is one of the predacious Beetles, and is as fierce and brave as it is voracious. It really seems not to know what fear is, and no enemy seems to frighten it. I once came across one of these Beetles at the foot of the old Clifton Baths stairs at Margate, and threatened it with the point of my stick. The Beetle at once dashed at the stick with open jaws, and fought most valiantly. Of course I did not wish to hurt the insect, so I merely continued the feigned attack, the Beetle retreating with its face to the foe and its jaws wide open, until it had fairly surmounted the whole flight of stairs, invariably turning round as it reached the top of each stair, and making a fresh dash at the stick. It was exceedingly angry, but did not show the least symptom of fear, though I repeatedly struck violently within a few inches of its head. I was so pleased with the dauntless courage of the Beetle, that, when it reached the top, I put it into a deep chalk crevice of the cliff, where it would be safe from the mischievous boys who infest the place.

This is one of the most active of Beetles. Being furnished, like all its family, with long and ample wings, and not being burdened, like the chafers, with a thick and heavy body, it flies with great rapidity, and can pass over incredible distances without being obliged to rest. It is equally active on the ground, for which reason the generic name of *Ocypus*, or 'swift-footed,' has been given to it. Some writers on entomology have given to this insect the generic name of *Goerius*, or 'mournful,' in consequence of its sombre and funereal colouring. The specific title *olens*, or 'stinking,' is given to it in consequence of the horrible emanations from the tail tubercles.

We will now glance at the life history of this Beetle, which, in spite of its ugliness, is really a very interesting one.

The eggs of all the Staphylinidæ are large in proportion to the creature which produces them, but those of the Devil's Coach-horse are larger than those of the largest British insect, being one-tenth of an inch in length and one-twelfth broad.

A group of these eggs is shown on Plate IV., just below the Beetle itself.

When these are hatched little larvæ issue from them, somewhat similar in form to the parent insect, though, of course, without any vestige of wings. These larvæ are quite as fierce as the perfect insects, and much more voracious, eating being indeed, as with all larvæ, the chief business of their lives. They are predacious, and, though they will devour carrion when they can procure it, will attack and kill any insect which comes near them, not even sparing their own kind. They have an ingenious mode of seizing their prey in the soft interval between the head and neck, and then, plunging their sharp and curved jaws deeply into its body, suck out its juices.

These larvæ can be found throughout the spring, and may often be captured by digging shallow holes in the ground in some sheltered spot, placing a piece of meat, a dead bird or frog, in the hole, and covering it with a stone so as to protect it from the elements, but leaving space for the ingress and egress of the Beetles. Towards the end of spring or the beginning of summer, the larva is full fed, and burrows a hole in the earth, in which it undergoes the change to the perfect form.

There is a strange peculiarity about the pupæ of these Beetles. With nearly all wing-bearing Coleoptera, the wings are folded under the elytra, even though the latter organs be comparatively short; but, in the pupæ of these curious Beetles, the wings are extended beyond the elytra and fold over the breast, so that two-thirds of their length is seen beyond the elytra. They remain in the pupal state for a fortnight or three weeks, and then assume the perfect form. The Beetle is most plentiful in the autumn. I strongly recommend any of my readers not to injure this Beetle, repulsive as it may appear. It does no harm, either to the garden, the orchard, or the field, but, on the contrary, from its inveterate insect-eating habits, rather confers a benefit on the agriculturist.

Specimens of this Beetle should always be set so as to show the beautiful wings; and one should be set on its back, in order to exhibit the peculiarities of the under side. None of the Brachelytra are easy insects to set properly, as their legs have a tendency to twist themselves in the wrong direction, or

to fall off altogether, and their long bodies have a way of shutting up like the joints of a telescope, so that the end of the tail only comes a little beyond the elytra, thus entirely altering the normal shape of the insect. These larger Staphylinidæ, however, are not so troublesome as the smaller genera, and the beginner will find it better to commence with them, and then proceed to the smaller kinds.

There are eleven British species of this genus, which is known by the long thread-like antennæ, with the last joint oblique at the tip and the large head.

Our next example of the Staphylinidæ is an insect of much less size and very different shape, called *Philonthus marginatus*, the only specimen that we can take of the very large genus, of which forty-seven British species are acknowledged. In this genus the thorax is squared, the antennæ and palpi are slender, and there is a strong tooth in the middle of each mandible. The antenna of this genus is shown on Woodcut No. VIII. Fig. *e*, the mandible, with its central tooth, at *a*, and the labial palpi at *c*. The name *Philonthus* signifies 'dung-loving,' and is given to this genus because the largest and most conspicuous species are found under patches of cow or horsedung. Some of the smaller species, however, live under heaps of decaying sea-weed, such as *Philonthus fucicola*, the latter term signifying some creature that inhabits sea-weed. The present species is generally to be found under dead leaves.

The colour of this little Beetle is black, but the legs and the margin of the thorax are reddish-yellow, a peculiarity from which it derives its specific name *marginatus*. The middle segments of the abdomen have their edges yellow. This is a very curious Beetle.

THE family of the Xantholinidæ may be distinguished from the Staphylinidæ by the position of the antennæ, which are inserted before, and not within, the base of the mandibles, and are consequently much nearer each other than those of the preceding family. The spiracles of the prothorax are conspicuous. The middle pair of legs is longer than the others. They are nearly all black, diversified with reddish-yellow, and are very slender bodied; and, in consequence of these charac-

teristics, the name of *Xantholinidæ*, or 'yellow threads,' has been given to them. This thread-like form allows the insects to pack themselves up into a very small space; and when they are reposing, they act like the Hottentots, and double themselves up in so small a space that when they are disturbed and unroll themselves, it is really surprising to see how the insect gradually develops its limbs and general form.

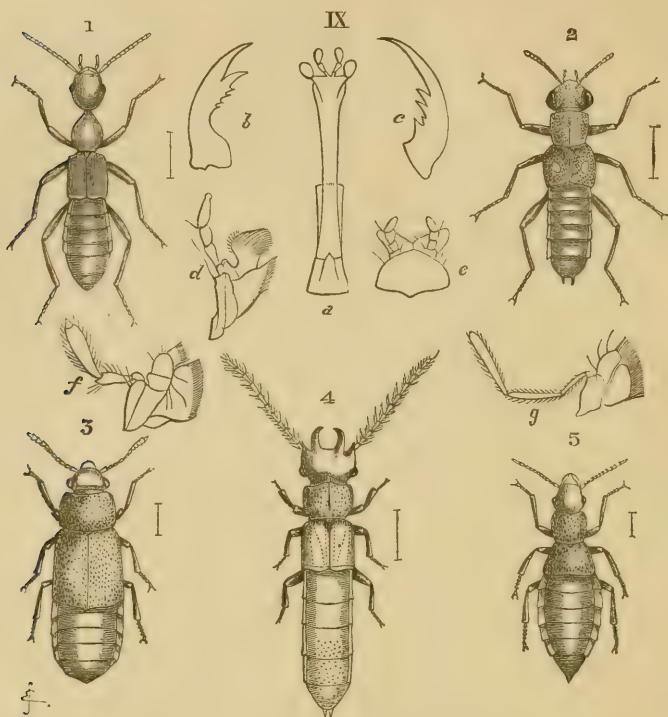
The characteristics of the genus can easily be seen by reference to Woodcut No. VIII. Fig. 5, which represents a common and pretty species called *Xantholinus glabratus*. The head is long, and the small eyes are placed well in the front. There is a small cylindrical neck, and the thorax is marked with bold punctures, which afford a valuable means of detecting the various species. The present species is black, with blood-red elytra. The disc of the thorax has four distinct rows of very large punctures. The sides of the head and thorax are punctured, and the whole surface is glossy, as indeed is expressed by the specific name *glabratus*, which signifies smooth or polished. Eight British species are acknowledged.

ANOTHER family, the Pæderidæ, now comes before us. In this family the spiracles of the prothorax are invisible, and the antennæ are set on the sides of the very front of the head. The maxillary palpi are rather long, and have the last joint so tiny that it scarcely looks like a joint. The left maxilla and its palpus are shown on Woodcut IX. Fig. *f*. The head is attached to the thorax by a very delicate neck, so that in a dried specimen great care must be taken lest the head should fall off. In some species there is a definite footstalk connecting the head and thorax together.

We can only take one example of this family, namely, the small but well-known Beetle called by entomologists *Stilicis fragilis*, a figure of which is given on Woodcut IX. Fig. 1. In this genus, of which there are seven British species, the head is wide and rounded, and the thorax is much narrowed in front. The curiously-toothed mandible is shown at Fig. *c* of the same illustration.

The present species is one of the few Brachelytra that has a popular name. It is called the Red-neck, on account of the bright-red colour of the thorax. Its head is shining-black,

covered with very small punctures, and the elytra are bluish-black edged with red. The legs are light-red. On account of the extreme tenuity of the connection between the head and the narrowed thorax, this insect is apt to fall to pieces in the cabinet if the drawer containing it be shut with a jerk, and it has therefore obtained the specific name of *fragilis*. It is not



1. *Stilicus fragilis*. 2. *Stenus bimaculatus*. 3. *Omalius florale*. 4. *Prognatha quadricornis*. 5. *Micralymma brevipenne*. a. *Stenus*, ligula. b. *Stenus*, left mandible. c. *Stilicus*, right mandible. d. *Prognatha*, maxillary palpus. e. *Prognatha*, labium. f. *Stilicus*, maxillary palpus. g. *Stenus*, maxillary palpus.

a very common insect, but is spread tolerably widely, and may be found by careful searching in hotbeds and heaps of decaying vegetable matter.

Other species of this curious genus can be found by looking in the proper places. *Stilicus geniculatus*, for example, inhabits chalky districts, and *Stilicus orbiculatus* must be sought in marshes.

NEXT comes the family of the Stenidæ. These insects may be known by the position of the antennæ, which are generally set between the eyes or on the front margin of the forehead. The basal joint of the maxillary palpi is long, and the last joint almost imperceptible. See Fig. *g* on Woodcut IX.

Sometimes the young entomologist is much puzzled by a phenomenon which takes place with sundry small Beetles belonging to the Brachelytra. As soon as they are killed a long and slender tongue-like organ darts from the mouth, and protrudes itself until it looks like a proboscis. These Beetles belong to the genus *Stenus*, of which we have an example in *Stenus bimaculatus*, which is shown on Woodcut IX. Fig. 2. This tongue-like organ is in fact composed of the ligula, the two paraglossæ, and the labial palpi, as may be seen by reference to the same illustration, Fig. *a*. The mandibles of this genus are strongly formed, having one very large tooth, and four very small teeth, as may be seen at Fig. *b*. The fourth joint of the tarsi has a slightly double lobe. The long and slender maxillary palpus is shown at *g*.

The present species is black, with the exception of a round tawny spot on each elytron, from which the insect has derived its specific name of *bimaculatus*, or 'two-spotted.' The surface is thickly and deeply punctured, and is covered with a scanty whitish down. There is a deep furrow along the middle of the thorax. The legs are tawny, with the exception of the knees and tarsi, which are black.

This is a very common and very good example of the genus, and indeed so well exhibits the characteristics of the family that it is worth a detailed examination. It is a very common insect, being found all over England, and almost always to be taken on the banks of ponds and rivers among the aquatic plants. In tolerably warm weather it may be taken running about upon the stems of the plants, and on cold days lurking in the muddy soil about their roots. Mr. E. A. Smith, to whom I am indebted for much information concerning the smaller Brachelytra, tells me that all the spotted *Steni* are found in the wettest situations. This genus is a very large one, containing more than fifty species.

THE next family on our list is that of the Omalidæ. In

these Beetles the spiracles of the prothorax are hidden, the antennæ are set on the sides of the forehead, and the maxillæ have a horny hook at the tip ; and there are two ocelli, or simple eyes, upon the back of the head, this being a very valuable characteristic in arranging these insects. As a rule the Omalidæ have flattened bodies, and long slender antennæ, and delight in damp places, whether wetted by fresh or salt water ; so that they can be found under heaps of decaying sea-weeds on the coasts, and under stones on the banks of ponds. Some of them may be found under bark, and some in flowers ; so that they have a very wide range of locality.

Our first example of this family, *Micralymma brevipenne*, is remarkable for its fondness for wet. The genus is known by its very minute elytra, the long and broad abdomen, and the long hairs upon the tarsi. A figure of the insect is given on Woodcut IX. Fig. 5.

The colour of this tiny Beetle is shining-black, and it may easily be recognised by its size, shape, and colour, and the locality in which it resides. It takes up its abode under decaying seaweed, but always selects a spot that is well below high-water mark ; its object being, apparently, to give itself a chance of being drowned or carried away to sea twice in the twenty-four hours. It remains in this singular locality throughout the whole of its life, and contrives, in some strange way, to pass through its transformations, subject to the perpetual washing of the waves.

ANOTHER example of the same family is shown on Woodcut IX. Fig. 3, its name being *Omalium florale*. In this genus the body is rather oval and flattened. The antennæ are short and hairy, becoming thicker at the tips. The thorax is short, somewhat heart-shaped, and narrowed behind. The four basal joints of the tarsi are short.

The species which serves as our example of the typical genus is greyish-black and shining, the surface being thickly punctured, and the punctures inclined to form striæ on the elytra. The legs are reddish, and the antennæ and palpi black. This is one of the flower-loving species, being found in the spring time frequenting the flowers of the hawthorn and willows. It is distributed over England generally, but does not seem to

be plentiful in any particular locality. Twenty British species of this genus are known.

WE have only space for one more example of the Brachelytra: it is drawn on Woodcut IX. Fig. 4. As may be seen by reference to the illustration, this is a very curious insect. It is the only British representation of the family to which it belongs, namely, the Piestidæ. In this family the spiracles of the prothorax are hidden, the coxæ of the front legs are globular, and those of the hind legs transverse; there are five joints to the tarsi, and the last segment of the abdomen is very small.

The genus is characterised by the flat, elongated body, the long and hairy antennæ, the long elytra, the five-jointed tarsi, and the horned head of the males. The maxillary palpus is shown at Fig. *d*, and the labium at *e*. The colour of this insect is shining-black. The elytra have four striæ, and on the disc is an oblique mark or dash of reddish-brown, the outer angle being dusky. The tip of the abdomen is chestnut, and the legs and antennæ red. The illustration represents a male insect, in which sex the sides of the head are developed into two sharp horns pointing forward. The mandibles are each furnished with a large horn. This very remarkable insect is not very scarce, and may be found under the bark of various trees. Kensington Gardens is a good locality for it, where it may be found lurking under the bark of elm-trees.

The scientific name of this Beetle is *Prognatha quadricornis*, and it is popularly styled the Four-horn.

I MAY here mention that the only viviparous Beetles at present known, belong to the Brachelytra. They are about one-tenth of an inch in length, and are found parasitic in the nests of the Brazilian Termites or White-ants. The abdomen is enormously large, and is turned back over the head, like the tail of a squirrel.

CHAPTER VI.

NECROPHAGA.

THE reader will probably observe that, in the groups of insects which have already been described, allusion has been made to the analogies between them and certain groups of vertebrates. The Geodephaga, for example, represent the land Carnivora, the Hydradephaga those of the water, and the Brachelytra represent in some degree the slender and lithe-bodied weasels. We now come to a group which takes among insects the part which is played among the higher animals by the hyenas and vultures, these Beetles being the scavengers of the insect world.

The name *NECROPHAGA*, i.e. 'carrion-eaters,' which distinguishes this group, is expressive of their character. By some systematic entomologists they are called *CLAVICORNES*, or 'club-horned,' because their antennæ, slender at the base, are expanded at their tips into a rounded knob. This shape of antenna is called 'clavate' by entomologists. The form of the antenna is an admirable characteristic by which these Beetles may be known. There is no palpus on the inner lobe of the maxilla, the scutellum is always conspicuous, and the elytra are wide, though not always long. Indeed, in many species they do not nearly reach the end of the abdomen, and are quite as short as those of many Brachelytra. In such cases they are generally 'truncate,' i.e. looking as if they had been cut off square.

THIS is the case with the first family of Necrophaga, the Silphidæ. The mandibles are powerful, as is required for the work which they have to perform, there is a very distinct labrum, and the trochanters of the hind legs are projecting. These are again subdivided into two sub-families; the first being called Silphina, and the latter Cholevina. The former sub-family may

be known by the fact that the antennæ have ten joints, and a very distinct and rounded club. Their wings are very large and powerful, as is needful for insects whose food is necessarily scattered over a very wide area. It is worthy of notice that, when they are flying, their elytra are carried very upright, so that their backs approach quite closely to each other.

The first genus of the Silphidæ is *Necrophorus*, a word which signifies 'carriage-bearer,' in allusion to the singular habits possessed by all the Beetles of this genus. They do not content themselves with merely eating their food, but they bury it, and then lay their eggs in it, so that it serves not only as a feast for themselves, but as a provision for their future young. In consequence of this habit, they go by the popular name of BURYING, or SEXTON BEETLES. It is a very appropriate name, for there is scarcely any dead animal or portion of an animal which they will not contrive to bury; and if it be too large for one Beetle, several others will take a share in the work. If the reader will refer to Plate IV., he will see that a number of these Beetles are engaged in burying a dead bird.

They will bury birds, frogs, rabbits, pieces of meat, or anything of a similar kind, and do it with wonderful rapidity; thus rendering a doubly important service, by removing the decaying animal matter from the surface of the earth, and helping to fertilise the ground by burying it below the surface. The manner in which these Beetles execute so difficult a task is admirably told by Mr. E. Newman, in his 'Letters of Rusticus:'—

'Two days after, I was again in Godbold's; and seeing the bullfinch lie where he had been left, I lifted him up by the leg, intending to make a present of him to a fine colony of ants established, a little further on, in the days of General Oglethorpe, and which had maintained their station ever since. They had made many a pretty skeleton for me, and I intended to add that of a bullfinch to the store; but the buzz of a Beetle round my head caught my ear. He flew smack against the bullfinch, which I was holding up by the leg, and fell at my feet. I knew that the gentleman was a Burying Beetle; and as I put the bird down for him, he soon found it, mounted upon it, and, after much examination, opened out his wing-cases and flew away. I will profit by his absence to tell you a bit of his history.

‘The Burying Beetle is about an inch in length ; he is black, with two bands across his back of a bright-orange colour : these bands are formed by two blotches of that colour on each of the wing-cases. He is a disgusting creature though in such a gay dress, being so fetid that one’s hands smell for hours after handling him ; and if he crawls on one’s coat, or other garments not often washed, the smell continues for days. The whole tribe of Burying Beetles lay their eggs in the bodies of dead animals, which, when possible, they bury for the purpose. In Russia, where death itself does not do away with distinctions, the poor people are buried but a few inches under ground, the coffin consisting of four boards roughly nailed together, and not particularly well fitted. The operation of burying is often at the expense of the country, and therefore done from necessity, not love. This mode affords great satisfaction to the Burying Beetles, as it saves them the labours of the grave-digger. They avail themselves of the bodies placed so nicely within their reach, and the graves are pierced with their holes in every direction. At evening, hundreds of these Beetles may be seen in the Russian burying-places, either buzzing about the graves, or sitting placidly at the mouths of their burrows, which lead into them.

‘The Burying Beetle in this country seldom finds so convenient a provision for him, and he is under the necessity of taking much more trouble. He sometimes avails himself of dead dogs and horses, but these are too great rarities to be his constant resort : the usual objects of his search are dead mice, rats, birds, frogs, and moles ; of these, a bird is most commonly obtained. In the neighbourhood of towns, every kind of garbage that is thrown out attracts these Beetles as soon as it begins to smell ; and it is not unusual to see them settling in our streets, enticed by the grateful odour of such substances.

‘The Burying Beetles hunt in couples, male and female ; and when six or eight are found in a large animal, they are almost sure to be males and females in equal numbers. They hunt by scent only, the chase being mostly performed when no other sense would be very available—viz. in the night. When they have found a bird, great comfort is expressed by the male, who wheels round and round above it like an eagle ; the female settles on it at once, without this testimonial of

satisfaction. The male at last settles also, and the bird undergoes the scrutiny of four at least of the senses—touch, smell, sight, and taste—for their heads are continually diving among the feathers of the bird, and a savoury and ample meal is made before the great work is begun. After the Beetles have appeased the calls of hunger, the bird is abandoned for a while; they both leave it to explore the earth in the neighbourhood, and ascertain whether the place is suitable for interment. If on a ploughed field, there is no difficulty; but if on grass or among stones, much labour is required to draw the body to a more suitable place.

‘The operation of burying is performed almost entirely by the male Beetle, the female mostly hiding herself in the body of the bird about to be buried, or sitting quietly upon it, and allowing herself to be buried with it. The male begins by digging a furrow all round the bird, at the distance of about half an inch, turning the earth outside. His head is the only tool used in this operation; it is held sloping outwards, and is exceedingly powerful. After the first furrow is completed, another is made within it, and the earth is thrown into the first furrow; then a third furrow is made, which being under the bird, the Beetle is out of sight. Now the operation can only be traced by the heaving of the earth, which soon forms a little rampart round the bird; as the earth is moved from beneath, and the surrounding rampart increases in height, the bird sinks. After incessant labour for about three hours the Beetle emerges, crawls upon the bird, and takes a survey of his work. If the female is on the bird, she is driven away by the male, who does not choose to be intruded on during the important business.

‘The male Beetle then remains for about an hour perfectly still, does not stir hand or foot; he then dismounts, diving again into the grave, and pulls the bird down by the feathers for half an hour. Its own weight appears to sink it but very little. The earth then begins heaving and rising all round, as though under the influence of a little earthquake; the feathers of the bird are again pulled, and again the bird descends. At last, after two or three hours’ more labour, the Beetle comes up, again gets on the bird, and again takes a survey, and then drops down as though dead, or fallen suddenly fast asleep.

When sufficiently rested, he rouses himself, treads the bird firmly into its grave, pulls it by the feathers this way and that way, and, having settled it to his mind, begins to shovel in the earth. This is done in a very short time, by means of his broad head. He goes behind the rampart of earth, and pushes it into the grave with amazing strength and dexterity, the head being bent directly downwards at first, and then the nose elevated with a kind of jerk, which sends the earth forwards. After the grave is thus filled up, the earth is trodden in, and undergoes another keen scrutiny all round, the bird being completely hidden; the Beetle then makes a hole in the still loose earth, and, having buried the bird and his own bride, next buries himself. The female lays her eggs in the carcase of the bird, in number proportioned to its size; and after this operation is over, and the pair have eaten as much of the savoury viand as they please, they make their way out, and fly away in quest of further adventures.'

WE will now examine these insects a little more in detail.

On Plate IV. Fig. 4, is seen the large *Necrophorus humator*, just by the head of the bird. This is a large, though not brightly-coloured species. It sometimes exceeds an inch in length, and its colour is deep, shining-black, with the three last joints of the antennæ reddish-yellow. The fringe-like pads of the tarsi are of the same colour. This is a very common species.

Under the neck of the bird two Burying Beetles are seen forcing their way beneath it. These are two distinct species, and are thus given, because in this attitude they display the distinguishing marks of the species. The Beetle nearest the bird's beak is *Necrophorus mortuorum*. It varies in size from not quite half to three-quarters of an inch. Its colour is black, but on the base of the elytra is a broad, waved, orange band, and at the apex is a curved spot of the same colour. The hinder tibiæ are straight, and the club of the antennæ is black. This is also a common species, and is sometimes found in decaying fungi, as well as in animal matter.

Next to this Beetle is a rather larger species, *Necrophorus vespillo*, which is, on an average, nearly a quarter of an inch longer than the preceding insect. A casual observer would

inevitably believe these insects to be of the same species, especially if he saw them apart. The practised eye of the entomologist, however, at once detects the marks of difference. In the first place, the hind tibiae are not straight, but much curved, like those of a bow-legged man, and the club of the antennae is orange. There is also a narrow line of golden down on the front of the thorax. In the next place, there is a considerable difference in the orange marks of the elytra, which are two broad waving bands, one across the base, and the other towards the apex, both being connected by a narrow band of the same colour upon the margin. This species is exceedingly variable in size, some specimens being barely half an inch in length, while others attain the length of an inch. It is very common in all parts of England. The specific name *vespillo* is Latin, and signifies a man who carried out the dead for burial at night.

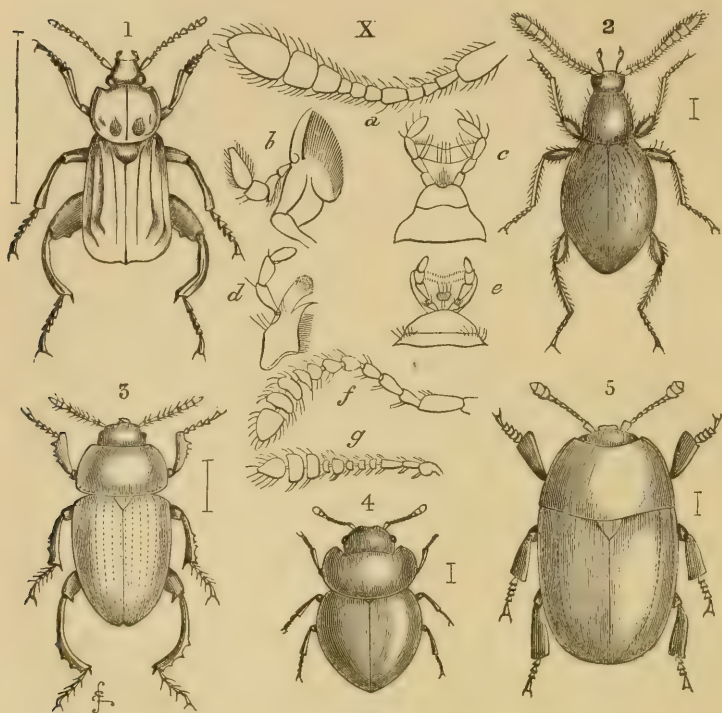
The reader may as well be warned that, although these Beetles are very pretty to the eye, they are not equally pleasing to the nostril, being in the habit of sending from their mouth a horribly fetid black fluid, the odour of which is as enduring as it is disgusting. This fluid is probably produced by the putrid nature of its food, for Beetles which have recently changed from the pupal form, and those which have fasted for some time, do not possess it.

We will now trace the progress of the insect from the egg to the perfect Beetle.

Soon after they are deposited, the eggs are hatched; the larvæ being rather long, fleshy, narrowed at each end, and having the segments, or rings, of the body very distinctly marked. The legs are very tiny, and much too small to move the large, heavy body. A curious substitute for legs is, however, found. On the upper surface of each segment is a horny plate, with strongly-toothed edges. By alternately elongating and shortening its body, the creature is able to force its way through the soft material on which it feeds, just as a snake glides upon the ground, or the worm beneath it. One of these larvæ, a very young one, is shown on Plate IV. Fig. 11.

When the larva has attained the length of an inch and a half, and is full-fed, it prepares for its change into the pupal state. This it does by ceasing to feed, and making for itself a

sort of cell or cocoon under the ground, in which it casts off its larva skin, and becomes a rather odd-looking pupa, having the end of its tail armed with two sharp spines, by means of which it is able to turn itself about in its cell, from which it emerges, in the spring, a perfect Beetle.



1. *Necrodes littoralis*. 2. *Scydmaenus tarsatus*. 3. *Anisotoma cinnamomea*, male. 4. *Agathidium lævigatum*. 5. *Meligethes aeneus*. a. *Scydmaenus*, antenna. b. *Meligethes*, maxilla. c. *Anisotoma*, labial palpi. d. *Necrodes*, maxillary palpus. e. *Necrodes*, labium. f. *Necrodes*, antenna. g. *Anisotoma*, antenna.

ON Woodcut No. X. Fig. 1, is a Beetle which is closely allied to the preceding genus, but can at once be distinguished by the shape of the antennæ, the club of which is egg-shaped, and not globular, and by the shape of the elytra, which gradually increase in width from the base to the apex, where they are abruptly truncated. Its name is *Necrodes littoralis*. The reader will notice the great size of the femora (or thighs) of the hind pair of legs. This is a sign that the specimen from

which it was drawn was a male. The colour of the Beetle is black, the three last joints of the antennæ being reddish-yellow. Each of the elytra has three smooth ridges running down its complete length, and a short one at the base between the second and third ridges. Between the second and third ridges there is a bold elevated tubercle, the second ridge bending towards it and then bending back to its course. Beneath, the body is glossy-black.

Though not so plentiful as the preceding insects, this is not a rare Beetle, and can be found in carrion, or under decaying sea-weeds. I have knocked it out of suspended moles. The antenna of this Beetle is shown on the same illustration, Fig. *f*, the maxillary palpus at *d*, and the labium at *e*. A favourite resort for this Beetle is the bank of a river, or the sea-shore, and on this account it has received its specific title of *littoralis*. This is the only British species.

THE genus *Silpha* is known by the flattened body, the antennæ being less boldly clubbed, and having eleven joints instead of ten. There are thirteen species inhabiting England, and they are all much smaller than the members of the preceding genera. Upon Plate IV. is shown the handsomest of the British Silphæ, namely, *Silpha thoracica*. It is represented as crawling over the body of the bird. This fine insect is readily known by its colouring. The head is black, and the thorax is brick-red, covered with a very short golden down, and much crumpled. The elytra are very much like those of the preceding insect, being black, and traversed longitudinally by three ridges, the second and third of which are connected by a raised tubercle. The surface, however, is more satiny than that of *Necrodes*, and, when viewed with a magnifying lens and a strong light, the space between the ridges is changeable in patches, like 'moiré' silk, and there are short ridges at the base of the elytra.

The larvæ of all the Silphas are very different from those of *Necrophorus*. Instead of being sluggish, fat, long-bodied grubs, they are active, flat, and wide, running about with wonderful velocity. A heap of old marrow bones is a very favourite haunt of these larvæ, and, if the bones are tapped so as to disturb without hurting their inmates, it is wonderful to see

how the flat, black larvæ come scurrying out, looking very much like black wood-lice, and perfectly well able to take care of themselves; while the larvæ of *Necrophorus* are utterly helpless on the surface of the ground.

Silphæ may be found in much the same localities as the preceding insects. The best places to find them are, however, the moles that are too often seen suspended on twigs, and the more moles there are near each other, the richer will be the harvest of *Silphæ*. I have found that ten moles on one branch contain many more *Silphæ* than double the number scattered over a wide area.

But, the 'happy hunting grounds' of any entomologist who is looking after *Necrophaga* are the 'keepers' trees, those monuments of misguided energy. The best keepers' trees, in an entomological point of view, are those of the New Forest, and on them are found the carcasses of owls, weasels, stoats, hawks, magpies, ravens, and now and then a rare bird or two, such as the honey-buzzard. The suspended carcasses look quiet enough, but when the net is held under one of them, and a series of taps administered, it is wonderful to see how it swarms with animal life. First, out come Beetles of various kinds, some trying to fly away as soon as they reach the open air, but most letting themselves fall into the net. Next comes a whole swarm of larvæ, and, when the bird is a large one, it really seems as if the creatures never would cease from pouring out. Those who wish to collect and watch the habits of these Beetles cannot do better than make a preserve for them by hanging up the body of a rabbit, a puppy, a kitten, or some such creature, so that it may be within the reach of the eye, and out of the reach of any except winged devourers.

The word *Silpha* is Greek, and signifies an ill-smelling insect, but the nomenclature of the ancient writers is so uncertain that we cannot absolutely identify the name with the insect. The specific name *thoracica* refers to the very conspicuous colour and the large size of the thorax. The larva of this Beetle is shown on Plate IV. Fig. 12, first appearing from under the wing of the bird.

THE sub-family of the *Cholevina* are known by their narrower bodies, and their heads being sunk in the thorax. One

of these Beetles, belonging to the typical genus, is drawn on Plate IV. Fig. 7, and is shown as crawling on the top of one of the mushrooms. Its name is *Choleva angustata*.

The genus, of which there are seventeen British species, is known by its narrow body, its long and slender legs and antennæ, the very obtuse hinder angles of the thorax, and the oval and striated elytra. The insect is represented of its natural size, which seldom varies much from one-sixth of an inch in length. The head is black and shining, the thorax is pitchy-black, becoming greyish at the margins and posterior angles. The elytra are rather variable in colour, black being the leading hue, but taking shades of red or grey according to the individual. The apex is round and short, and each elytron is marked with seven faint striæ. The legs are pale reddish-yellow. The body is covered with a very fine and very short yellowish down.

It is not uncommon to take a specimen that is pale rusty-red or yellow, the reason for this paler hue being that the Beetle has only recently emerged from the pupal state, or that the atmosphere has not exercised its full influence upon it. When it has been exposed for a few days to the air and light, the reddish-yellow will change to the dark-red or grey-black which is the usual colour of the Beetle.

NEXT comes the family of the *Scydmanidæ*, of which we shall take one example, namely, *Scydmanus* [*Eumierus*] *tarsatus*, which is shown on Woodcut X. Fig. 2. These insects are all very minute, the present species, though only the twelfth of an inch in length, being the largest of the family. They are all covered with down, are without wings, and have the elytra coming completely to the end of the abdomen. The facets of the eyes are very boldly marked, and the peculiar form of the antennæ, which are terminated with three very large joints, each increasing in size, may be seen by reference to the same illustration, Fig. *a*. The maxillary palpi are very conspicuous.

The head and thorax of this species are black, and the elytra are very deep chestnut. Like the rest of its kin, it is to be found in hotbeds, leaf-heaps, cucumber frames, and similar localities. The name *Scydmanus* is Greek, and signifies ‘sullen.’

THE family of the Anisotomidæ is known from the Silphidæ by several points of structure, none of them being singly very conspicuous, but not to be mistaken in the aggregate. They are much more globular, the Silphidæ being flattened; the legs and antennæ are short, and the mandibles have a single tooth at the base. Like the preceding family, these are small insects, the largest being *Anisotoma cinnamomea*, which is shown on Woodcut X. Fig. 3. This Beetle is about one-sixth of an inch in length. In this genus the tarsi of the first and middle pairs of legs have five joints, while those of the hinder pair have but four joints. The club of the antennæ has three joints, as may be seen at Fig. *g* of the same illustration. The structure of the labial palpi is shown at *c*. The generic title *Anisotoma* is derived from a Greek word signifying unequal, and has been given to these Beetles in consequence of the inequality of the joints of the front and hind tarsi.

The specific name *cinnamomea* refers to the colour of the insect, which is very much like that of cinnamon, with the exception of the club of the antenna, which is black. There are eight punctured striæ on each of the elytra. The hinder tibiæ are very long and boldly curved in the male, but not in the female insect, which has them small and straight. This Beetle is found chiefly upon the truffle. There are twelve or thirteen species of this genus.

Another member of this family is shown on Woodcut X. Fig. 4. Its name is *Agathidium lævigatum*.

In this genus the antennæ are short, and the club is egg-shaped and composed of three joints. The thorax is large and round, and with overhanging sides, and the body is very globular. All the tarsi have four joints. The present species is smooth shining-black, with the exception of the lateral and posterior margins of the thorax, which are edged with a narrow line of rust-red. The elytra are not striated. Like all the members of the genus, this insect has a habit of rolling itself into a ball when alarmed, so that it looks more like a very small shot than an insect. It inhabits fungi and decaying wood, dead leaves, and similar localities. It can be best obtained by taking up handfuls of dead leaves from under hedges, and shaking them over paper, when the Agathidia will appear like little black beads.

They will not stir for a long time, unless the sun be shining powerfully on the paper.

THE important family of the Histeridæ now comes before us. These are flattish square-bodied Beetles, with a sort of steely look about them, and as hard to the touch as if their elytra were veritable pieces of plate armour. It is no easy task to get a fine entomological pin through these creatures, the pin either bending, or its point repeatedly slipping off the hard and polished surface of the Beetle in a manner calculated to injure the temper as well as the pin. I always used to keep by me a rather fine needle fixed in a handle, and projecting about one-third of an inch, so that I could pierce the hard elytra with the steel point, and then introduce the pin. This needle was useful in setting many other hard-bodied Beetles, especially some of the weevils.

These hard and glossy elytra are much shorter than the body, and abruptly truncated; but below them may be seen a beautiful and wide pair of wings packed away with wonderful neatness. The basal joint of the antennæ is very long, and the club is boldly marked, the three last joints being almost fused into a globular and velvety knob. The generic name of *Hister* is derived from a Latin word signifying an actor or a mimic, and is given to these Beetles on account of their habit of simulating death when alarmed. The popular name of MIMIC BEETLES is often given to them by entomologists.

On Plate IV. Fig. 8, may be seen one of the handsomest species of this genus, namely, the FOUR SPOT MIMIC BEETLE (*Hister quadrimaculatus*). The colour of this insect is black, but on each elytron is a large C-shaped red mark reaching from the base nearly to the apex. This mark is often divided in the middle, so as to produce the effect of four red spots on the back. A narrower line of the same colour mostly runs along the margin; but this, like in many other Beetles, is apt to be exceedingly variable in the arrangement of its colouring.

This, together with the rest of the genus, can be found in or under decaying animal matter, patches of cowdung being favourite resorts. The pertinacity with which these insects will feign death when captured is most remarkable, for they will endure almost any amount of rough handling without

giving the least signs of life, the legs being folded flatly under the body so that they are scarcely visible. Indeed, I scarcely know whether they or the Pill Beetles, which will presently be described, are the most obstinate in this respect.

The larvæ of the Mimic Beetles are also to be found in cow-dung, and are not in the least like their parents, being long-bodied, cylindrical, whitish in colour, with two forked appendages at the tail. Some species prefer dead animals, and may be found in the moles to which reference has already been made. About fourteen British species of *Hister* are known; and the young entomologist will find that, owing to variations of colour, he will often be rather perplexed to determine the exact species of some new capture.

WITH great reluctance I am obliged to omit several genera, and must proceed at once to the next family, the Nitidulidæ. The Beetles of this family have short clubbed antennæ. The head is sunk in the thorax as far as the eyes, and the mandibles are notched at the tip; the thorax is rather square, and the tarsi have five joints. The body is flattened. The little Beetles which are found in such numbers in flowers, and have such shining bodies, mostly belong to this family, to which the name of *Nitidulidæ* has been given on account of their glittering bodies.

The typical sub-family, the Nitidulina, are known by the length of the elytra, which reach to the last joint of the abdomen, and the shape of the thorax, which does not cover the base of the elytra. One of these insects, *Nitidula* [*Omosita*] *depressa*, is shown at Fig. 9 on Plate IV., and is represented as crawling up the stem of the central mushroom.

The body of this Beetle is oval, and, as may be inferred from its name, is much flattened. Its colour is rusty-brown, and the surface is thickly punctured. Upon the elytra are some faint oblong black streaks, and a curved mark of paler hue than the rest of the body. This is a very plentiful species, and may be found in fungi, as represented on the plate, under the bark of trees, and even in old bones.

The larvæ of these Beetles feed on various substances, chiefly on decaying vegetable matter. One of them, for example, *Nitidula grisea*, is found about the burrows made by willow-

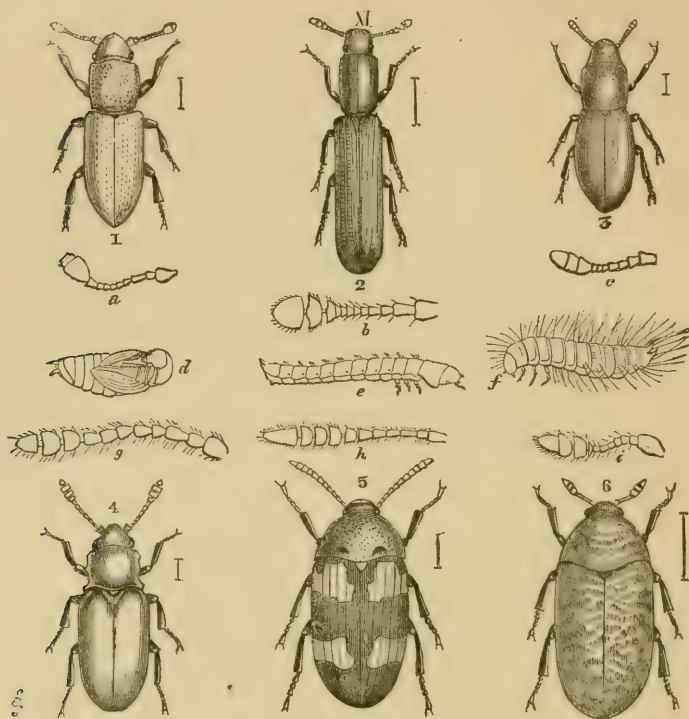
feeding caterpillars. It is a whitish grub, thick towards the shoulder and tapering to the head and tail. The segments are very distinctly marked, and the last segment is armed with two hook-like appendages curving upwards. When it is about to change to the pupal form, it descends the trunk of the tree, and hides itself in the moist earth about the roots; and after it has obtained its perfect form, it is generally to be found in the crevices of the bark.

ON Woodcut X. Fig. 5, is shown another of these Beetles, *Meligethes œneus*. This genus is known by the squared and metallic body, the long elytra, and the third joint of the antennæ, exactly as long as the fourth and fifth together. The form of the maxilla is shown on the same illustration at Fig. b. All the Beetles of this genus are very small, and are invariably to be found in flowers, creeping from their hiding places under the petals when the flower is gathered or shaken. Being very minute insects, a careful examination with a somewhat powerful lens is needed to distinguish the species, and, even then, the little creatures are so like each other in size and colour, that the entomologist is obliged to abandon the usual mode of determining species, and to trust to the number of notches in the tibiæ of the first pair of legs.

This species is variable in colour, being blue-black, violet, or dark green-blue, over which is a sort of brassy gloss. It seldom exceeds the twelfth of an inch in length, and is a very good example of its genus. It is plentiful throughout England.

STILL keeping to the same family, we take another of the sub-families, the Ipsina, which have the front of the head lengthened and covering the labrum, the fourth joint of the tarsus being very minute. Our first example of these insects is *Rhizophagus ferrugineus*, which is shown on Woodcut XI. Fig. 1. These Beetles have much narrower bodies than the preceding, the antennæ are short and boldly clubbed, with a large basal joint. The head is not sunk in the thorax, and the elytra are not so long as the abdomen. They are mostly to be found under the bark of trees, but some are fond of inhabiting old bones, and are even parasitic in ants'

nests. The name *Rhizophagus* signifies 'root-eating,' and there are about ten British species. Though they are for the most part vegetable-feeders, some at least of the species are known to be carnivorous, and have been detected in eating the larvæ of other bark-feeding Beetles belonging to the genus *Hylesinus*.



1. *Rhizophagus ferrugineus*. 2. *Colydium elongatum*. 3. *Anommatus duodecim-striatus*.
 4. *Cryptophagus pilosus*. 5. *Mycetophagus quadripustulatus*. 6. *Dermestes murinus*.
 a. *Rhizophagus*, antenna. b. *Colydium*, antenna. c. *Anommatus*, antenna. d. *Dermestes*, pupa. e. *Colydium*, larva. f. *Dermestes*, larva. g. *Cryptophagus*, antenna.
 h. *Mycetophagus*, antenna. i. *Dermestes*, antenna.

The colour of this species is smooth shining rust-red, sometimes deepening into reddish-black. There is a pit on either side of the head, the elytra are thickly punctured and striated, and beneath it is rust-red. This Beetle has been chosen because it is the largest of the genus, sometimes exceeding one-sixth of an inch in length. The rather peculiar antenna of this genus is shown at Fig. a of the same woodcut.

THE family of the Colydiidæ have the antennæ nearly straight, and not bowed as in the preceding family, and the tarsi are four-jointed. Most of them are found in wood, but they may be found among grass heaps, in sandy places, and other localities. One of the most curious examples of this family is the insect which is represented on Woodcut XI. Fig. 2, and called by the name of *Colydium elongatum*. A glance at the figure will show the appropriateness of this name, the whole body, and especially the abdomen and elytra, being elongated in a most extraordinary manner, really looking as if the Beetle had been drawn out like wire. The colour of this curious Beetle is smooth shining-black, the elytra being reddish at the base, and deepening into black at the apex, near which is an oval reddish spot, varying in colour and size in different specimens. This insect lives chiefly in the burrows of wood-eating Beetles, especially those of *Sinodendron* or *Hylesinus*, and therefore is so seldom seen that it is considered a valuable addition to the cabinet. But, when one of its haunts is detected, a number of the Beetles can generally be found. Mr. Ingall, for example, took a quantity of these insects out of an old elm rail near Sydenham. By some authors the generic name of *Nemosoma* is prefixed to this Beetle. This is a very appropriate name, signifying 'thread-bodied.' It is the only British species of its genus.

The larva of this Beetle is shown at Fig. *e* on the same woodcut. Mr. Westwood went to visit the elm rails at Sydenham, and there succeeded in procuring many examples of larvæ and perfect insects. He remarked that the perfect insects were sluggish during the day, but that at night they became more active, trying to bite each other if they met. The larvæ, like many other creatures which inhabit burrows, can run backwards as easily as they can forwards, and this they do by means of a clasper on the end of the body. They are sluggish except when excited, and then move about very much after the manner of the Rove Beetles, moving their head from side to side, and opening their strong jaws as if in menace.

ANOTHER member of this family is remarkable for being without eyes. This is *Anommatus duodecim-striatus*, which

is shown on Woodcut XI. Fig. 3. It is the only British species of its genus. This tiny Beetle is about the fourteenth of an inch in length, and may be found in stores of flour and rice, especially the latter, from which fact some entomologists infer that it has been imported into England, and is not an indigenous British species. Its colour is warm-chestnut, and its body is very smooth and shining, but deeply punctured, and the elytra are regularly striated. The generic title *Anommatus* signifies 'eyeless,' and is given to the insect in consequence of the entire absence of eyes, so that it really deserves the name of BLIND BEETLE. Perhaps the reader may remember that several other orders of insects afford examples of eyeless species, especially among the exotic ants.

THE family of the Cryptophagidæ will be represented by one example.

In all these little Beetles the antennæ have eleven joints, and are boldly clubbed at the end. The elytra are not truncated, and the coxæ of the first and intermediate pair of legs are globular, while those of the hind pair are cylindrical. The name of Cryptophagidæ is given to these Beetles because they feed mostly on cryptogamous plants, especially the fungi. Like the last family, the species are very much like each other, and require much care before they can be ascertained. In examining the details of all these minute Beetles, I have found a compound microscope with a two or one-and-a-half-inch object-glass better than an ordinary pocket lens, but a Coddington lens will answer nearly as well in experienced hands.

One example of this family is *Cryptophagus pilosus*, which is shown on Woodcut XI. Fig. 4, and the form of the antenna is shown at Fig. *g*. The genus is known by the shape of the margins of the thorax, which are more or less toothed. The present species is oblong, and its colour rust-red, the surface of the body being sparingly covered with very fine down. The thorax is thickly punctured, especially on the disc. In this Beetle the marginal toothing of the thorax is not so conspicuous as in most of the species, and is rather undulated than toothed. It is to be found in and about fungi. There are about seventeen species of this genus.

THE next family is called Mycetophagi, a word having much the same signification as that of the last family, the Greek word *Myces* signifying a fungus, especially the kind of fungus that grows on tree-trunks. The insects of this family are rather convex-bodied and oval, and covered with a delicate down. The tarsi have four joints, except in the males, which have the tarsi of the first pair of legs only three-jointed.

Our example of this family is taken from the typical genus, and is known by the name of *Mycetophagus quadripustulatus*, a figure of which is given on Woodcut XI. Fig. 5. The genus is distinguished by the shape of the thorax, which is as wide at its base as the base of the elytra, the margins of the thorax and elytra forming one continuous line without any division. The club of the antennæ is rather long and composed of five joints, the last joint being egg-shaped, and the four others short and disc-like. The antenna is shown at Fig. *h* on the same woodcut. Six species are known in England.

This really seems quite a large insect when we compare it with some of those which have lately been described, as it sometimes reaches a length of a quarter of an inch. The head of this Beetle is reddish, and the antennæ are black in the middle and red at the tip. The thorax is black, narrow in front and broad behind, with rather sharp posterior angles, and a rounded pit on each side towards the base. The elytra are black, and on each of them are two reddish-yellow spots, one at the base, and a smaller one over the apex. Some specimens have the smaller spot so pale as to be scarcely visible, while in others the two spots are united by a streak of pale yellow. This is a very pretty little Beetle, and easily to be found when the searcher knows where to look for it. The interior of fungi, rotten wood, and similar localities are the dwellings of this Beetle, which may be found in perfection about the middle of summer. As a rule, all these fungi-loving Beetles are in good preservation when captured, as the nature of their habitations shields them from injury.

THE next family, the Dermestidæ, is a very interesting one to the entomologist, although he can but hold its members in bitterest hatred. The word *Dermestes* is of Greek origin, and signifies 'skin-eater.' The name is but too appropriate, as all

possessors of zoological collections know to their cost. It is the *Dermestes* which forces taxidermists to use the dangerous arsenical soap in their preparations, and it has been the means of depriving many a hard-working man of his best teeth, the arsenic loosening them so that they fall out almost at a touch. By way of a set-off, it is the *Dermestes* which drove the late Mr. Waterton to the invention of his wonderful mode of taxidermy, in which no arsenical soap is used, but by which the skin is rendered so hard and elastic, that it is able to retain the form of the animal without having a wire, a piece of wood, or even a pinch of cotton wool inside it. Full many a valuable museum has been utterly ruined by these destructive Beetles, which, even when the skin is poisoned with arsenical soap, will attack the hair or the feathers, and strip the creature as bare as if it had been shaved. Moses Harris, the old entomologist, mentions that he found these Beetles alive in the body of a living Eyed-hawk Moth.

This family is distinguished by their short, straight, and doubled antennæ, their small and retractile head, the five-jointed tarsi, and the length of the elytra, which cover the abdomen. In the typical genus, the antennæ are shorter than the thorax, and the club is egg-shaped, as seen at Fig. *i* on Woodcut XI. The palpi are thread-like and shorter than the maxillæ, and the first joint of the tarsus is shorter than the second. For illustration of this genus I have selected the well-known BACON BEETLE (*Dermestes lardarius*), which is shown on Woodcut XI. Fig. 6.

This is really a pretty, though not gaily coloured, Beetle, its body being black, and its elytra having a very broad greyish band across the base, on which are three black or pitchy spots. On examination with a lens, the band is seen to be composed of a short but thick grey down, the black spots being simply places on which the down does not grow, so that the black of the elytra is rendered visible.

This Beetle may be found plentifully in the 'keepers' trees' which have already been mentioned; and even after the animals have been so dried by exposure that their skins are as hard as horn, the *Dermestes* will attack them, its sharp teeth enabling it to overcome the hardened skin. The chief havoc caused by this Beetle is due to the larvæ, one of which may be seen

figured on Woodcut XI. Fig. *f*. Its colour is whitish-brown above and white below, and it is profusely covered with long hairs. The cast skins of these larvæ may be seen abundantly when the Beetle has taken possession of any place, and by them the museum owner is often warned of the danger which has come on his collection. The reader will see that, like many other destructive insects, it is most valuable in its right place, and does good service by removing from sight objects which are not only unpleasant to the eye and nostril but injurious to the health. In these places it should be protected and encouraged; but when it makes its way into a house, extermination is the only course to be used.

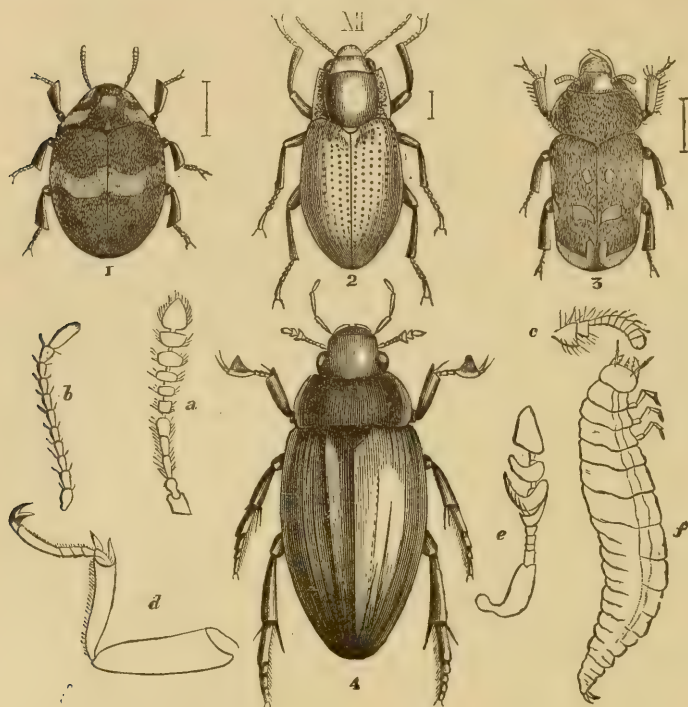
WE now come to the Byrrhidæ, or Pill Beetles, so called from their rounded shape, and the manner in which they can hide their limbs and antennæ when alarmed. There is no difficulty in distinguishing Beetles belonging to this family. The antennæ are gradually thickened towards the extremity, and the head is very small and deeply sunk in the thorax, with which it can be completely retracted in most of the species.

The machinery by which the legs are packed up is extraordinary, and this alone would serve to indicate the family. On the tibiæ there is a groove in which the tarsi are received when doubled, the tibiæ fold closely to the femora, and the whole leg, thus reduced into a very small compass, is received into a groove under the body. In fact, the legs are packed up very much like the joints of a portable easel. The head being at the same time withdrawn into the thorax, the antennæ lie pressed closely against its sides, so that when the Beetle has thus packed away all its limbs, it does not bear the least resemblance to an insect. This mode of concealment, or rather of evasion, is rendered more perfect by the fact, that the surface of the body is covered with fine down, which retains the dust of the roads on which it so often travels, and gives to the Beetle the aspect of a little round dusty stone. And, so pertinaciously does it keep this attitude when alarmed, that it will suffer its limbs to be torn from its body rather than give the least sign of life.

The typical genus has the antennæ rather flattened, and shorter than the thorax, the basal joint being large, the second

small and globular, and the third long and slender. The club is formed by a series of joints regularly increasing in size, the last joint being egg-shaped. One of these antennæ is drawn on Woodcut XII. Fig. *a*. The thorax is waved behind, and the body is very convex.

The species which has been chosen for illustration is the BANDED PILL BEETLE (*Byrrhus fasciatus*), which is drawn on



1. *Byrrhus fasciatus*. 2. *Elmis æneus*. 3. *Heterocerus flexuosus*. 4. *Hydröus piceus*, male. *a*. *Byrrhus*, antenna. *b*. *Elmis*, antenna. *c*. *Heterocerus*, antenna. *d*. *Hydröus*, fore leg of female. *e*. *Hydröus*, antenna of male. *f*. *Hydröus*, larva.

Woodcut XII. Fig. 1. The colour of this Beetle is black, the thorax having a decided golden tinge. Upon the elytra are a number of very short black stripes, and in the middle is a reddish-yellow band, shaped as is seen in the figure. This is a tolerably plentiful species, though it is not so often found as the COMMON PILL BEETLE (*Byrrhus pilula*), which is without

the yellow band across the elytra. Five species of this genus inhabit England.

THE next family is the Heteroceridæ, which have the antennæ short, with a long flattened club of seven joints, as may be seen by referring to Woodcut XII. Fig. c. The legs are evidently adapted to burrowing in the earth. The body is flat, broad, and covered with a thick silken down. They are all frequenters of the water, and live in burrows which they excavate in the damp soil. There is only one genus in this family, containing seven species, of which our example is *Heterocerus flexuosus*, which is drawn on Woodcut XII. Fig. 2. This insect is yellowish or dun-coloured, very finely punctured, and covered with down. Along the elytra is a wavy or flexuous stripe composed of black spots irregularly disposed, a mark from which the Beetle derives its specific name of *flexuosus*. Towards the shoulders there is a black spot, and another in the middle towards the suture, the latter not being so dark or well-defined as the former.

It is a water-loving Beetle, and has been taken on the banks of the Thames, near Gravesend. Mr. Stephens remarks, that to obtain any of the Beetles of this family is a very easy process. All that is required is, to go to the bank of some river—tidal rivers are the most frequented—and then to stamp and trample on the muddy bank. The little Beetles are alarmed at the turmoil overhead, and come out to see what is the matter, when they can be captured. The insect-hunter must, however, be very quick in seizing them, as they are back again almost immediately, or hide themselves in crevices where their tiny bodies cannot be seen.

LIKE the preceding Beetles, the Parnidæ are water-lovers, and some of them prefer to live under the water rather than above it. The head is sunk into the prosternum, and the anterior segments of the abdomen are fixed together and immovable. They are divided into two sub-families, the Parnina and Elmina, which may easily be distinguished by examining the coxæ of the front pair of legs. In the Parnina they are cylindrical, and in the Elmina globular. One example of this family is taken from the latter sub-family, and

is called *Elmis aeneus*. One of these Beetles is shown on Woodcut XII. Fig. 2, and the antenna is drawn at Fig. *b* of the same illustration.

All the species belonging to this genus, of which five British examples are known, are very curious insects. They are plentiful and yet are seldom found, and, indeed, are hardly ever found except by those who know where to look for them. In the first place, they are small, and would escape observation, and in the next they are subaquatic in their habits, not swimming about conspicuously like the Hydradephaga, but clinging to the under side of submerged stones in swiftly-running streams. Most aquatic Beetles prefer still water, but the stream can never be too swift for the *Elmis* Beetles, which will even select a waterfall as their place of residence.

The present species is the commonest of the genus.

As may be inferred from its specific name, the surface of the insect has a brassy gloss. The thorax is squared, very convex, and on either side of the disc is an elevated straight line. The elytra are striated and punctured, and the under surface of the body is clothed with thick golden down. Besides the characteristics already given, the last joint of the tarsi is very long, and armed with two large, sharp, and curved claws, by means of which they are enabled to retain their position on the stones in spite of the rushing water. It is rather remarkable that, although the upper surface of the body is very smooth, and the Beetles pass the greater part of their time submerged in rapid streams, the body is often so caked with mud that the shape of the insect is nearly obscured.

Now we come to a very familiar but little understood insect, popularly called the BLACK WATER BEETLE. Like some of the preceding species, it has been confounded with the Hydradephaga, merely because it inhabits the water, no reference being made to its structure, or even its mode of feeding. Indeed, I believe that scarcely any, except entomologists, have the least idea that the *Dyticus* and the present Beetle are not the same insect, the only difference being that one is much larger than the other. Now, if we examine this Beetle, *Hydröus piceus*, we shall find a vast number of structural differences, as well as complete divergence in habits.

The Beetle belongs to the family of Hydrophilidæ, i.e. water-lovers. Sometimes the two halves of the word are transposed, the Beetles being called Philhydrida, the signification being exactly the same in both cases. The family may be known by the size of the palpi, which are as long as the antennæ and sometimes longer—the latter organs never having more than nine joints, and sometimes only six—and by the double lobe of the maxilla and the very short mandibles. The tarsi have five joints. The typical genus has the mandibles armed on the inside with three strong teeth, notched at their tips; the second joint of the maxillary palpi is very long, and the elytra become narrower towards the apex.

The insect is represented on Woodcut XII. Fig. 4, of its natural size, showing that, with the exception of the Stag Beetle, it is our largest coleopterous insect. A glance at the figure will show one of the principal peculiarities of this Beetle, namely, that the palpi far exceed in length the antennæ, and project in front considerably before those organs. The sexes are easily distinguished by a glance at the antennæ, and the tarsi of the first pair of legs. The antenna of the male is drawn on the same woodcut, Fig. *e*, and in the same sex the last joint of the front tarsi is very much dilated, and assumes the form of a partly flattened triangle. The same limb in the female does not possess the widened joint, and may be seen by reference to Fig. *d*. The metasternum terminates in a sharp spine, so long that its point reaches beyond the coxæ of the last pair of legs.

The colour of this Beetle is smooth blackish-olive, the margins of the elytra taking a bluish tinge. The wings themselves are very large, and have a very fine effect when spread. On each of the elytra are eight striæ, and the breast is clothed with thick yellow down. The metasternum is developed, as in the *Dyticus*, into a pointed process, but in this insect the weapon is simply needle-shaped, and is about the size of an ordinary darning-needle. It is black, highly polished, and very sharp. There is much variation in tint in different individuals, but the average hues are as given above.

The life history of this insect is a very curious one. The female Beetle is furnished with a complete silk-spinning apparatus, the spinnerets being placed, not in the mouth, as is the

case with the silkworm, but at the end of the tail. With these instruments she forms a cocoon shaped almost exactly like a turnip, being round, and having a pointed projection from one side. Within this cocoon, which soon becomes hard and water-tight, and is fastened to the stem of a water-plant, the eggs are placed; and in a time varying from a fortnight to six weeks, according to the warmth of the weather, the larvæ are hatched. About fifty or sixty eggs are placed in one cocoon, and by this extraordinary provision they are preserved from harm until the larvæ are able to escape into the water and shift for themselves. They are very small at first, but rapidly increase in size until they attain the length of three inches.

One of these larvæ is shown at Fig. *f*, and is represented as partly grown. It is soft, fat, and dusky in colour, and feeds voraciously on molluscs and other aquatic animals, as might be inferred from the large and curved jaws. It is one of the air-breathing larvæ, and is therefore obliged to come frequently to the surface in order to take in a supply of air, which is done by means of a filamentous appendage at the end of the tail. Somewhere about July the larva has completed feeding; and then leaves the water and crawls up the bank, searching for a soft spot in which to burrow. Here it sinks its tunnel, and forms an oval cocoon, in which it awaits its change into the pupal state.

The Beetles belonging to this group, being, like the larvæ, air-breathers, are forced to come to the surface for the purpose of respiration; and they contrive to carry down a supply of atmospheric air by enclosing a bubble under the bodies, where it looks like a globe of quicksilver as they swim about. As this species is not only handsome but harmless, it is in great favour with the keepers of aquariums, and is in consequence quite scarce in many places where it used to be plentiful, the professional dealers having ransacked all the streams within easy reach of London.

THE family next in order, the Sphæridiidæ, are distinguished from the preceding family by the shape of the tarsi, which are not fitted for swimming, and the hinder pairs of which members have the first joint much longer than the others. They are all small insects, rather globular in form, from which peculiarity

the name of the family is derived ; and they are dark-coloured, black being the usual hue, relieved in some species by reddish spots. In the genus *Cercyon*, from which our example is taken, the club of the antennæ is large and bold, the palpi are slender, and the mentum is broad and flat.

As is the case with most red and black Beetles, the colour is exceedingly variable in different individuals, so different indeed, that the present species, *Cercyon anale*, which is drawn on Woodcut XIII. Fig. 2, has been described under four separate names, each name being used to represent a different species. Its colour is black, but the elytra are generally tinted towards the apex with reddish-chestnut, the size and exact tint of this mark varying exceedingly ; and in some specimens the elytra are altogether black. Like the rest of the genus, it can be found in cowdung.

Formerly some sixty species of *Cercyon* were catalogued, but they have now been reduced to seventeen genuine species ; two-thirds of the imagined species proving, on careful investigation, to be nothing but varieties. In one case, that of *Cercyon nigriceps*, the same insect had been described under seven different names by the same naturalist.

CHAPTER VII.

LAMELLICORNES.

THIS chapter will be given to that very important group of insects, the LAMELLICORN Beetles, popularly called CHAFERS. The former term is composed of two Latin words signifying 'leaf-horned,' and is applied to these Beetles because the club of the antennæ is composed of a series of flat plates or leaves, which are movable like the rays of a fan, except in the Stag Beetle and its kin. The antennæ are always short, with a long or large basal joint, and set near the eyes and in front of them. If the reader should have skill to open an insect, he is strongly recommended to do so, in order to see the singular manner in which the large and apparently heavy bodies of these insects are lightened by a great number of air-vessels connected with the breathing tubes. These air-vessels extend all over the body, and are found even in the head.

The larvæ are fat, fleshy, soft-skinned grubs, feeding on vegetable matter, mostly, though not always, in a state of decay; and the last segment of the body is much larger than the others. After they are full-fed, they make cocoons from the chips of wood or other fragments of the material on which they have been feeding; and therein await their change into the pupal and perfect form.

THE first family of the Lamellicornes is the Cetoniidæ, or Rose Beetle family. We have but few examples of these beautiful insects in England, and one or two of them are very rare. In this family the antennæ are short, and have only ten joints, three of them forming the club. The body is broad, and the elytra are flattened and not quite long enough to reach the end of the abdomen. A very familiar example of this family is given on Plate V. Fig. 1, namely, the common ROSE BEETLE (*Cetonia aurata*).

In this genus there is a curious structure of the epimera, or side pieces, of the metathorax, which are largely developed, so that they act upon the bases of the elytra, and prevent the insect from opening them widely. Any of my readers who has watched a Rose Beetle flying must have noticed that, although the wings are very ample, the elytra are scarcely opened at all, so that they cover some portion of the lower wings; whereas Beetles generally hold the elytra well elevated, and out of the way of the wings. The edges of the elytra are deeply waved in this genus.

This is a truly handsome insect. The upper surface of the body is beautiful shining-green, glossed with gold. The elytra have a number of impressed dots and curved marks scattered irregularly over them, and towards the apex are a number of scattered whitish marks, very variable in size, hue, number, and shape, according to the individual insect. Below, it is bright polished-copper.

The perfect Beetles are generally to be found in roses, especially the white and wild roses, which they are thought to damage in some degree. Gardeners have an objection to these Beetles, because they are apt to settle upon the flower of the strawberry, and devour just those parts by which the fruit is produced. In the south of England, the privet blossom is a favourite resort of these Beetles. The larva, however, does not content itself with such light diet as rose-leaves, but lives on the less poetical but more substantial nourishment afforded by decaying wood, in which it remains for three years. One of these larvæ is shown on Plate V. at Fig. 6, as it appears when occupying its dwelling among the debris of rotten wood at the roots of the tree. As may be seen by reference to the plate, it is by no means an attractive-looking creature, and gives no sign of the magnificent colours which its fat, soft, white body will soon develope.

Sometimes, on opening a wood ant's nest, one of these larvæ is found in it, a circumstance which has gained for it the name of King of the Ants. It most probably takes advantage of the large quantity of wood-chips, bits of straw, fir-leaves, and similar material, with which the ants make their nest; and finds therein an abundant supply of food. The ants do not

meddle with it, probably finding that it remains in one spot, and does not interfere with the conduct of their nest.

The reader will notice that the larvæ is represented in a curved attitude. This is done because it is the natural, and indeed the needful, attitude of these larvæ. Their legs are so small, and the end of the body is so large, that they cannot support themselves by their legs; and, if laid on a flat surface, immediately roll over on their sides. This clumsiness—if we may so call it—of form is not peculiar to the Rose Beetle, but is found in all the group.

After it has remained in the larval state for the full period, it makes for itself a cocoon from the wood-chips or other materials on which it has been feeding; and it sometimes happens that when a decayed tree-trunk is suddenly blown or cut down, a great quantity of these cocoons roll out from among the ruins. Even when the larva has taken up its abode in an ants' nest, it makes a cocoon from the surrounding materials. A group of these cocoons is shown on the same plate, Fig. 7.

A somewhat similar but rarer Beetle also inhabits England. It is called *Gnorimus nobilis*, and may at once be recognised by a glance at the elytra, which are not waved at their edges. Otherwise, in habits, colour, and general shape, it is very much like the Rose Beetle, and the body is shining green-gold. The elytra, however, are wrinkled, and there are white spots scattered over them. There are also white spots on the edges of the abdomen, and the breast is covered with hairs. It is generally found on umbelliferous flowers.

WE must say a word or two respecting the well-known insect, the *Phyllopertha horticola*, which is called indifferently BRACKEN CLOCK or JUNE BUG, and is known to anglers by its old Welsh name of COCH-Y-BONDHU, often corrupted by them into the rather ludicrous word Cockerbundy. It is about half an inch in length, and has reddish-brown elytra and dark-green head and thorax. It is found in great abundance—often too great abundance for any except anglers—busily engaged in devouring the leaves, blossoms, and even the young fruit of our orchard-trees. In its larval state it does much harm to the grasses, of which it devours the roots, much after the fashion



PLATE V.

CHAFERS.

1. *Cetonia aurata*.
2. *Melolontha vulgaris* (Male).
3. *Geotrupes stercorarius*.
4. *Lucanus cervus*.
5. *Lucanus cervus*, larva (very young).
6. *Cetonia aurata*, larva (three parts grown).
7. *Cetonia aurata* (Pupa cases or Cocoons).
8. *Geotrupes stercorarius*, larva (young).
9. *Melolontha vulgaris*, larva (three parts grown).

PLANT:—

Wild Rose (*Rosa canina*).



of the cockchafer grub, whose ill deeds will presently be recorded.

The insect belongs to the family Rutelidæ, the members of which have strong, horny mandibles, those of the preceding family being only horny on the outside; and, besides these differences, the elytra are lined with a membrane which projects a little behind. In the genus to which we are referring, the antennæ have nine joints, the clypeus is short, and the thorax is narrowed behind. The name *Phyllopertha* is composed of two Greek words, signifying 'leaf-destroyer,' and is very appropriately given to this insect, on account of the ravages which it makes among the leaves of fruit-trees. The specific title of *horticola* is formed from two Latin words, and signifies 'garden-frequenting.'

NEXT we come to the small though important family of the Melolonthidæ, which includes those insects which are popularly called Cockchafers. Only five species of this family inhabit England, and of these only two are even tolerably common. These two, however, more than compensate by their enormous numbers for the paucity of the other species; and in some seasons are so exceedingly plentiful that they become an absolute pest to the agriculturist, laying waste thousands of trees, and destroying acre upon acre of pasture land.

The family of the Melolonthidæ have very strong mandibles, as is evident from the havoc which the insects make among leaves, and the outer lobe of the maxillæ is strongly toothed. In the typical genus, the antennæ are ten-jointed, and the club of the male is composed of seven joints, while that of the female contains only six. The flattened plates of the club are much smaller in the female than in the opposite sex.

On Plate V. Fig. 2, is shown a male specimen of the common COCKCHAFER (*Melolontha vulgaris*) crawling to the trunk of a tree. The insect is so well known that a detailed description is scarcely necessary. The peculiar bent projection at the end of the abdomen is worthy of notice, as are the rows of triangular white spots along its sides. There is a greyish down on the breast, and the elytra are covered with a yellowish down. Unless the insect have quite newly emerged from the pupal state and been handled very carefully, the down is sure to be

rubbed off, and the beauty of the specimen greatly impaired ; so that a really perfect specimen even of so common a Beetle is worth having.

The life history of this insect demands a brief notice. The female deposits her eggs in the ground, where in due time they are hatched, and straightway begin to feed upon the roots of grass, which form the chief part of their diet. They remain in the ground for three years, continually destroying grass-roots, and increasing to a wonderful size ; so large and fat, indeed, that their tightened skin seems scarcely able to hold its contents. And when they are dissected, it really seems still more wonderful that they should not have burst with sheer fat and gorging. I have opened numbers of them, and found them more troublesome than any other larvæ, the quantity of fat being so enormous that the spirits of wine in which they were sunk had to be changed over and over again before it was sufficiently clear to allow the structure to be seen. Then, even when that difficulty was overcome, another remained, for the whole of the stomach and intestines was so crammed with a mixture of grass-roots and earth, that it looked like a well-stuffed and very black sausage, with a very thin skin. The quantity of roots consumed by one of these insects is very great ; and in some places they have so completely destroyed the grass, that the turf has been completely detached from the ground, and might be rolled up by hand as easily as if the turf-cutter's spade had passed under it. These mischievous grubs do not confine themselves to grass-roots, but eat many of the underground crops, the potato often suffering terribly from them. One of these larvæ is shown on Plate V. Fig. 9, as it appears when about one-third grown.

I believe that the rooks are our best friends with regard to this grub—technically known as White-worm in some parts of England. They seem to be able to detect the presence of the grub by hearing its teeth at work on the grass-roots, and then, pecking a hole with wonderful rapidity, they drag out the grub and take it home to their young. The rooks, in fact, aid us in ridding our grass lands of the White-worm just as do the starlings in destroying the larvæ of the daddy-long-legs.

When full-fed, the grub makes for itself a cocoon in the earth, and then emerges, only to work as much destruction

above the soil as it did below. In the larval state it fed upon the roots of grasses, and was out of sight; it now feeds on the leaves of trees, and is out of reach. In this way the Beetles are scarcely less mischievous than they were in their former state, for they will sometimes denude whole tracts of trees, so that, in the full beauty of summer-tide, the trees look as if the season were the depth of winter. In this country we are almost ignorant of the harm which the Cockchafer can do, for, although our crops and potatoes often suffer severely from its attacks, they are not wholly ruined, as is the case on the Continent. In consequence of the noxious character of this Beetle, I never had the least scruple in killing it, and can strongly recommend it to my readers as an excellent 'subject' for the study of insect anatomy. Thus a double service is rendered: first to the country by its death, which prevents it from perpetuating a numerous progeny; and next to the investigator, because it affords him a subject which will train both the hand and the eye, and which can be so easily obtained that he need not be afraid of spoiling a few specimens. Although this Beetle is at present nothing but an unmitigated pest, I cannot but think that it may yet be made to turn to the service of man. I should not wonder if the silkworm were originally a great plague to gardeners until its real value was discovered, and so it is not utterly impossible that some mode may be found of turning the Cockchafer to account. At present it is but of little use to man. It is employed rather largely during its brief existence in the Beetle state as bait for sea-fish, and there has been an attempt made to procure a sort of coarse oil from the fat bodies of the grubs. Some utilitarians, of abnormal boldness, have proposed that it might be prepared as an article of food, and have suggested that it may be thought as much a delicacy as is the palm-worm of the West Indies. But they entirely forget that the palm-worm lives in the interior of trees, and that it contains nothing but vegetable matter, whereas a full-grown Cockchafer grub contains a full thimbleful of earth, a substance which no amount of cooking could render palatable.

THE family of the Geotrupidæ has eleven joints in the antenna, of which three form the club, and the margin of the head divides the eyes somewhat like the structure of the

Gyrini, except that, in the case of those insects, the eyes are divided by a broad, flat band, and in the present family by a narrow ridge of horny substance. The body is very convex and the thorax large, in order to give room for the muscles that move the large wings and the powerful digging fore-legs. Three genera of Geotrupidæ exist in England, two of which will be illustrated by examples.

On Plate V. Fig. 3, may be seen one of the commonest English species, represented as crawling up the trunk of a tree. This is the *Geotrupes stercorarius*, popularly known as the DOR BEETLE, the FLYING WATCHMAN, the DUMBLE-DOR, and similar names, according to the locality in which it lives. The genus *Geotrupes* has the basal joint of the antenna rather long, and the fourth joint shorter than the fifth, the body very convex, and the basal joint of the tarsus is the shortest. The generic name *Geotrupes* is formed from two Greek words, signifying 'earth-digger,' and, as we shall presently see, is a very appropriate one.

The colour of this species is black above, sometimes glossed with green or blue, and rich shining-violet beneath. On the middle of the clypeus there is a sharp tubercle. The thorax is smooth, except at the margins, which are thickly punctured, and on each side there is a nearly circular impression, thickly punctured in the interior. The middle of the scutellum is punctured, and the elytra are striated, the spaces between the striæ being smooth. The sexes may be distinguished by means of the tibiæ of the first pair of legs and the femora of the hind pair, the male having on the inner side of the front tibia a single erect spine, and the inner edge of the hind femora strongly toothed. As this insect is liable to much variation in colour, it is necessary to call attention to these minute points of structure by which the species can be definitely ascertained.

The life history of this Beetle may be briefly told as follows:—

In the autumn evenings the Beetles may be seen flying about in large circles, as if they were predacious insects quartering the ground in search of prey. In one sense, this is exactly what they are doing, as they are hunting after a favourable spot wherein to place their eggs, and are wheeling over the ground in hopes to find one. Attracted probably by the scent,

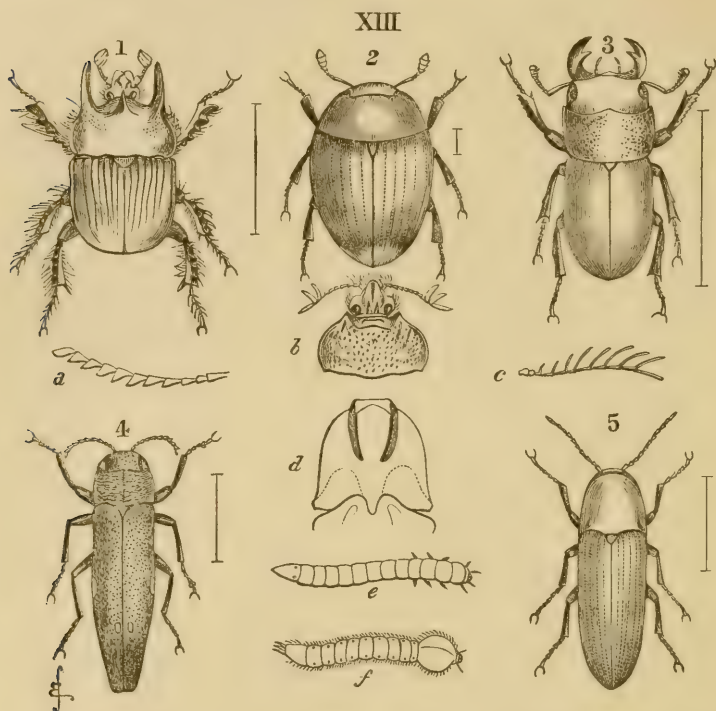
the Beetle discovers a patch of cowdung, alights near it, crawls upon it, and straightway burrows through the soft material, and is lost to sight. When she—for it is the female who does the work—reaches the earth, she does not cease to burrow, but goes on with her labour until she has excavated a perpendicular tunnel some twelve inches in depth, and carried a quantity of the cowdung into it. In this substance she deposits an egg, crawls out of the burrow, and proceeds to make another, and so goes on until she has laid all her eggs.

The egg remains in its concealment until it is hatched, and then the larva consumes the food which its mother has taken the trouble to bring down for it. After this is eaten, the grub is strong enough to ascend the burrow and obtain as much food as it wants at the entrance. Within this retreat the larva passes through its transformations, and then ascends to the outer air, ready to take its part in the work of preparing nurseries for a future progeny. Five species of *Geotrupes* are known in England. Twice as many species have been described, but recent investigations have shown that exactly half the supposed species were simple varieties.

ON Woodcut XIII. Fig. 1, is represented a Beetle of a very odd appearance, the sides of the thorax being prolonged into a pair of very formidable horns, a shorter horn occupying the centre of the anterior margin. This is the male *Typhæus vulgaris*, the only British example of the genus. The female has only the veriest rudiments of horns, the anterior angles of the thorax being merely developed into a short, sharp prominence, like the teeth of a saw, while the place of the central horn is taken by a ridge running across the forehead. Indeed, owing to the absence of these horns, the female is so unlike the other sex, that no one who was ignorant of entomology would be likely to believe the two creatures to be nothing more than different sexes of the same insect. The female so closely resembles the ordinary Dor Beetle, that the older entomologists comprised the *Typhæus* within the genus *Geotrupes*.

The name of *Typhæus* was given to this genus in the days when classical mythology was the source of new names for insects, and to this genus the name of *Typæhus* was given on

account of its menacing aspect, which was fancifully compared to the giant Typhœus, who frightened Zeus and the other gods out of heaven merely by his looks. As, however, was the case with its ancient prototype, the Typhœus is not nearly so terrible as it seems, and its array of horns cannot do the least injury to the hands of its capturer. At Fig. *b*, on the same woodcut, the head of the female Typhœus is shown.



1. *Typhœus fumatus*. 2. *Cereyon anale*. 3. *Doreus parallelipedus*. 4. *Agrilus biguttatus*. 5. *Elater sanguineus*. *a*. *Agrilus*, antenna. *b*. *Typhœus*, head of female. *c*. *Elater*, antenna. *d*. *Elater*, head, under side. *e*. *Elater*, larva. *f*. *Agrilus*, larva.

There is no possibility of mistaking this insect, which is the only British example of its genus; which, in addition to the characteristics that have been already described, has the first and last joints of the tarsus of equal length, and longer than the others. The colour of the insect is shining-black, the elytra being regularly but not very deeply striated. There is, however, considerable variation in this insect, as even in some

males the horns are comparatively small, and little better developed than those of the female. The colour also slightly varies, a warm-chestnut tint underlying the black, so that the entomologist ought to procure a series of specimens, in order to show the usual varieties of form and colour. It varies in size as well as in colour, some specimens being five-sixths of an inch in length, while others are barely half an inch long. This extreme difference in size is common among the *Lamellicornes*.

Considering that the *Typhœus* is a very common insect, it is surprisingly little known, and I have often found that entomologists who restricted themselves to the *Lepidoptera* alone have been totally ignorant of its existence, and expressed much surprise when I showed them a fine male *Typhœus*. This insect is in one sense an extremely interesting one, inasmuch as it is one of our few British examples of the strange and almost grotesque forms assumed by male *Lamellicornes*, but which are seldom seen except in exotic Beetles.

This insect may be found in all parts of England: some of those in my own collection were taken near Oxford, and the others in Wiltshire, on the Downs. The end of May and beginning of August are the times when it is in best condition, and at the latter season it may often be seen lying dead in roads or pathways. Like the Dor Beetle, it is a burrower, and has been taken while making its tunnel in sand.

THERE is a large family of small Beetles which must not be passed over without a brief notice. This is known by the name of *Aphodiidæ*, a name formed from two Greek words which refer to the habits of the different species, which are always to be found in cowdung. They are rather oblong and cylindrical in shape, and the elytra cover nearly the whole of the body. Many species are among the commonest of our British insects, and they must be sought in their accustomed haunts if the beetle-hunter wishes to obtain a good series of specimens. A stick will generally suffice to eject them from their hiding-places, but the 'digger' which has been already described is a more effective instrument, as the insects can be dug out of their shelter beneath the surface of the earth. Forty species of *Aphodius* are known to entomologists.

THE family of the Lucanidæ is represented in England by four genera, but by very few species, only one British species belonging to each genus. This family may at once be known by the club of the antennæ, which, though formed of a series of plates,* is unlike that of the other Lamellicornes, in that the plates cannot be folded together, and are arranged so as to look as if the club were simply pectinated. The claws have a very slender secondary claw inside them. Besides these external modifications of structure, the internal anatomy of the Lucanidæ differs from that of the other Lamellicornes, the nervous system being distributed in a manner which at present is not known in any of the Lamellicornes which have been dissected. In the males the mandibles are enormously developed, and, in consequence of these distinctions, many entomologists have thought that the Lucanidæ ought not to belong to the Lamellicornes, but to be formed into a group by themselves. The name of *Pectinicornes*, or 'combed antennæ,' has been suggested as an appropriate title. As to this proposed alteration, Mr. Rye very judiciously remarks, that such a change ought not to be made until all the known Lamellicornes have been dissected, and their nervous system examined.

The genus *Lucanus* is distinguished by the flattened body, the apparently pectinated four-jointed club of the antennæ, and the enormous jaws of the male, which are often half as long as the head, thorax, and body together. Our only British species is the well-known STAG BEETLE (*Lucanus cervus*), which derives its popular name from the jaws of the male, which look somewhat like the horns of a stag. In some parts of the country it goes by the name of HORN-BUG. A figure of this fine insect is shown on Plate V. Fig. 4, the Beetle being represented in the act of flying.

This is the largest of the British Beetles, as it sometimes attains a length of nearly three inches. The size, however, is extremely variable, as some males are barely half that length, and have their jaws comparatively small and weak. These are generally called undeveloped males, their inferiority being probably due to a want of food while in the larval state. Lest, however, a small and degenerate race of Stag Beetles should be perpetuated, the males always fight for possession of the

females, and the consequence is, that none but the largest and strongest individuals have a chance of obtaining a mate.

The head and thorax of the Stag Beetle are black, profusely punctured. The elytra are deep-chestnut, becoming black on the margins, and at first sight appear to be quite smooth, but are, in reality, covered with the finest imaginable punctures. The jaws are of the same colour as the elytra, and the legs are black. The female is shaped like the male, with the exception of the jaws, which are small, curved, and sharply pointed. The head, too, is smaller than that of the male, because the muscles attached to the jaws are comparatively small. The peculiar maxillæ, with their hairy inner lobes, can be seen on page 9, Fig. 4b. When in their places, these lobes are close together, and look like a yellow tongue.

This Beetle is in some parts of England very common, and in others not only rare, but absolutely wanting. I hunted insects industriously at Oxford for a series of years, and not only never saw a living Stag Beetle within many miles of that city, but never knew that a specimen had been taken in that locality. There is no apparent reason why it should find that Oxford does not suit it, for the same trees flourish there as they do in Kent, where it is one of the commonest of the Beetle tribe, and the same water that flows past Oxford rolls through the Thames valley of Kent. Whatever may be the reason, the fact exists; and I well remember my gratification and astonishment when I first saw the Stag Beetles flying about nearly as plentifully as Cockchafers or Dor Beetles.

The larva of this insect somewhat resembles that of the Rose Beetle, and lives in rotten wood. I have tried to rear this larva, but unsuccessfully, as the creature *would* die before it had become full-fed. Indeed, I never saw the larva even attempt to eat, though I kept it in a mass of the same wood in which it was living when captured. One specimen, however, which is now alive on my desk, did eat the white paper lining of the box; but it entirely refused the decayed wood, though I repeatedly placed scraps of its natural food within its jaws. One of these larvæ is represented on Plate V. Fig. 5, as it appears in its home. The oak supplies its favourite food, but it also lives in the willow; and, according to some entomologists, the willow-fed specimens are smaller than those which live in the oak. These

larvæ often do very great harm, their powerful jaws enabling them to eat into the living as well as the dead wood, and into the roots themselves. It remains in the larval state for at least four, and perhaps as much as six years, and when it is about to become a pupa, makes for itself a cocoon out of the wood-chips with which it is surrounded.

The jaws of the male are quite as formidable weapons as they appear to be, the muscles which close them being very powerful, and their sharp and strong teeth inflicting a severe bite. Mr. Curtis mentions that the jaws retain the power of biting long after the head has been separated from the body, and that in one case when a severed head of a Stag Beetle was taken home in the evening, it retained on the following morning sufficient power to pinch the finger. Still, severe as is the bite of the male Stag Beetle, that of the other sex is still more severe, the points of the strong, sharp, curved jaws being made to meet in the flesh.

At first sight it would appear that the insect must be a carnivorous one, and that such formidable weapons were used for the purpose of capturing and destroying other insects. In reality the Stag Beetle is essentially a feeder on juices, which it obtains by wounding twigs and fruits with the sharp teeth of its mandibles. If kept in captivity, it will feed on moistened sugar, and has a curious way of flattening itself on the ground, in order to reach the sugar with its tongue. Indeed, it only uses its jaws as weapons of offence, when it fights for the possession of the female, or when it is captured and wishes to escape. It will bite fiercely in such a case, and, if kept alive, will resent with open jaws any attempt to disturb it.

ON Woodcut XIII. Fig. 3, is represented an insect which is evidently allied to the Stag Beetle, the short, powerful, toothed mandibles looking exactly like the tips of the Stag Beetle's jaws. This Beetle is called scientifically *Dorcus parallelopedus*, but, I believe, has no popular name. The word *Dorcus*, in Greek, signifies an antelope, the name being given to the insect in consequence of the shape of its jaws, which are thought to resemble the horns of the antelope, as those of the preceding insect resemble the horns of the stag. The specific name is in allusion to its peculiar form.

The genus is distinguished from *Lucanus* by the comparative shortness of the jaws in the male, and the club of the antennæ, which is more leaf-like than that of the Stag Beetle. In the female the jaws are comparatively small and simple. It is not a pretty Beetle as far as colour goes, for it is dull, dead-black, the whole of the surface being covered with very fine punctures. In the male these are very much finer on the head and thorax than on the elytra, so that these members have a sort of gloss somewhat resembling that of a new black kid glove. If the head be examined, the eyes will be seen to be nearly severed by the margins of the head, which overlap them considerably in front, though not behind.

This insect is found plentifully in those parts of the country where the Stag Beetle abides, and, in consequence, is very common along the Thames valley of Kent. It is, however, to be seen in places where the Stag Beetle does not live, for in the late Mr. Hope's note-book I found a memorandum, stating that in 1820 he had caught the *Dorcus* at Oxford, where the Stag Beetle is, as above-mentioned, not known. My own specimens were taken in Wiltshire. Like the Stag Beetle, this insect lives in rotten wood, the female digging holes in which she may lay her eggs, the powerful fore-legs being used for the purpose.

Although, as has been already stated, this insect has no popular name, there is no reason why it should not have one. We will therefore confer one upon it by literally translating its scientific title, and will call it the ANTELOPE BEETLE.

CHAPTER VIII.

STERNOXI.

THE group that now comes before us is a very boldly marked one, and yet has been described under more than one title. Some entomologists have selected the word *Serricornes*, or 'saw-horned,' because the antennæ are serrated, i.e. notched, like the teeth of a saw, two examples of which may be seen on Woodcut XIII. Figs. *a* and *c*. As, however, so many Beetles that do not belong to this group have their antennæ serrated, the word has been abandoned in favour of *Sternoxi*, or 'sharp-breasted,' because the prosternum, or under side of the thorax (see Woodcut I. Fig. 8), is prolonged backwards with a sort of spike, which fits into a cavity between the middle pair of legs. This projection is technically named the 'mucro,' or dagger. The body is long, rather cylindrical, but slightly flattened, and the antennæ are mostly serrated, but sometimes pectinated, and in a few instances nearly plain and thread-like. There are other distinctions, but these are so bold and evident that they will be quite sufficient for the reader's purpose.

Most of these insects possess the curious power of leaping, which has earned for them the popular title of SKIPJACK BEETLES. Their legs are very short, so that if the Beetle should by any chance fall on its back on a flat surface, it would have no power of recovering itself, but for the curious piece of mechanism of which the 'mucro' forms a portion. Whenever the Beetle falls on its back, and cannot recover itself, it lies still for a few moments, and then begins to arch its body, so that it rests only upon the end of the abdomen and the back of the head, the thorax being well elevated. By this movement, the mucro is drawn out of the groove into which it fits. Suddenly, the insect reverses its position and springs the elastic mucro into its place, thus driving the base of the elytra against the ground, and causing itself to fly up into the air.

This apparatus is shown on Woodcut XIII. Fig. *d*, which represents the under side of the thorax. The mucro is seen in the middle, as it appears when its point is lifted out of the hollow, and the two dark lines above represent the grooves in which the antennæ lie in order to protect them from the shock of the fall. The spring is always accompanied with a slight but sharp clicking sound, from which these insects have derived the name of CLICK BEETLES. There is an absolute necessity for this curious provision of nature. The Click Beetles are all feeble, slow, and defenceless, and their only way of escaping from an enemy is by loosening their hold of the herbage on which they are crawling, and allowing themselves to drop to the ground. The sweep-net is very useful in catching these Beetles, as it anticipates the movement, and captures them as they fall.

If put on a plate or other hard substance, the insect will jump a surprising height. On a very smooth surface like that of a plate, the legs can take no hold as the insect falls, and it generally rolls over on its back again. It instantly repeats the jump, and again failing to secure a hold, seems to get into a passion, leaping seven or eight times in rapid succession, and then to turn sulky, lying on its back without moving a limb. These insects have large wings, and are able to use them well, though without much power of directing their course. They always fly with the head well upwards and the body drooping downwards, and are so slow that they can be captured easily by hand. They have an ingenious habit of flying to some upright green stem, clinging to it just below the seed-vessels, and quickly closing their wings; so that, even when the spot where they alighted has been observed, it is no easy matter to see them.

WE will now proceed to describe one or two typical examples of this group. The first family, the Buprestidæ, is known by the short serrated antennæ, the hinder angles of the thorax, which are not produced backward into spines, and by the manner in which the prothorax sits so closely against the base of the elytra that there is no power of leaping. Thus, in one sense, they have no right to be ranked among the Skipjacks or Click Beetles, except as Skipjacks that cannot skip, and Click Beetles

that cannot click. The body is always hard, rigid, and metallic in its colouring. In England, our species of Buprestidæ are comparatively small; but many exotic species, especially those of South America, are of very large size, and absolutely gorgeous in colour, their bodies having every shade of scarlet, blue, purple, gold, and copper, and their surfaces being in very many cases polished like burnished metal.

I may here mention that the word *Buprestis* is of Greek origin, and signifies 'ox-swelling.' The name was given by the earlier naturalists to a sort of Beetle which, according to popular ideas, was eaten by cattle together with the grass, and caused their bodies to swell to such an extent that the animals died. The name has for many years been applied to this family of Beetles, and, in default of a better, has been retained. I need scarcely remark that a banquet on green clover is quite sufficient to cause an ox to swell and perhaps die, without the addition of any Beetle whatever.

Of these insects our example will be *Agrilus biguttatus*, which is represented on Woodcut XIII. Fig. 4. In the genus *Agrilus* the body is cylindrical, the thorax is squared, and the basal joint of the antennæ is very short.

This is a lovely insect, and it is a great pity that its beautiful colour cannot be properly indicated by black and white. The colour of the upper surface is brilliant-blue or green, with a bronzed gloss, and towards the apex of each elytron, and close to the suture, is a cream-coloured spot covered with thick but short hair. The whole of the upper surface is rendered richer in its colouring by the way in which it is broken up by wrinkles and punctures on the head and thorax, and profuse granulation on the elytra. Beneath, it is also blue or green, with the exception of several pure white down-covered spots on the sides. The legs are of the same colour as the elytra.

Although this is not a very common species, it is at all events not one of our rarities, and is one of the many beautiful British Beetles which are to be captured in Darenth wood. This is the largest of the British Buprestidæ, and is the best representation of its gorgeous exotic relations. It flies well, and can be taken on the wing as well as by the sweep-net. As for the hand, it has scarcely a chance against this lovely but provoking Beetle, which takes alarm at the least movement of its

intended captor, folds its limbs and antennæ closely to its body, and falls to the ground, where search is almost useless, its small green body harmonising so well with the colour of the herbage.

At Fig. *f* on the same woodcut the larva of this insect is shown, rather magnified, though not so much as the Beetle itself. In its larval stage of existence the insect lives in dead or decaying trees, usually just under the bark. The present species prefers the oak, and burrows under the bark of the old oak-stumps that are left by the woodcutters after they have felled the trees. When the larvæ are full-fed they make their cells between the bark and the tree itself, and, like many other brightly-coloured Beetles, remain in the pupal cell for some time after they have thrown off the pupal envelope, so that the integuments of the body may gain their full hardness before the insect moves into the open air.

PASSING by the family of the Eucnemidæ, which, like that of the Buprestidæ, has the prothorax fitting so closely against the base of the elytra that the insect cannot leap, we come to the typical genus, of which our example is *Elater sanguineus*, drawn on Woodcut XIII. Fig. 5. In this family the antennæ are long, and inserted just in front of the eyes, which are large and round. The two hinder angles of the thorax are produced into spines pointing backwards, and the mucro is able to move freely in the cavity into which it fits, in consequence of the distance between the base of the elytra and the thorax. In this genus the tarsi are bristly, the joints becoming gradually smaller, the body is flattened, and the sides of the thorax are not widened. The name *Elater* is Greek, and signifies a 'striker' or 'hurler,' the name being given to the insect in consequence of its power of hurling itself into the air.

The ground colour of the present species is black, but it is covered with brown-black or red-brown down, the thorax being rather convex, punctured, and having a short and shallow furrow behind. The elytra are of a more decided hue, being blood-red (whence the specific name, *sanguineus*), and are striated and punctured. It is not a very common insect, but may be found in woods. I have taken it in a copse on the Wiltshire downs.

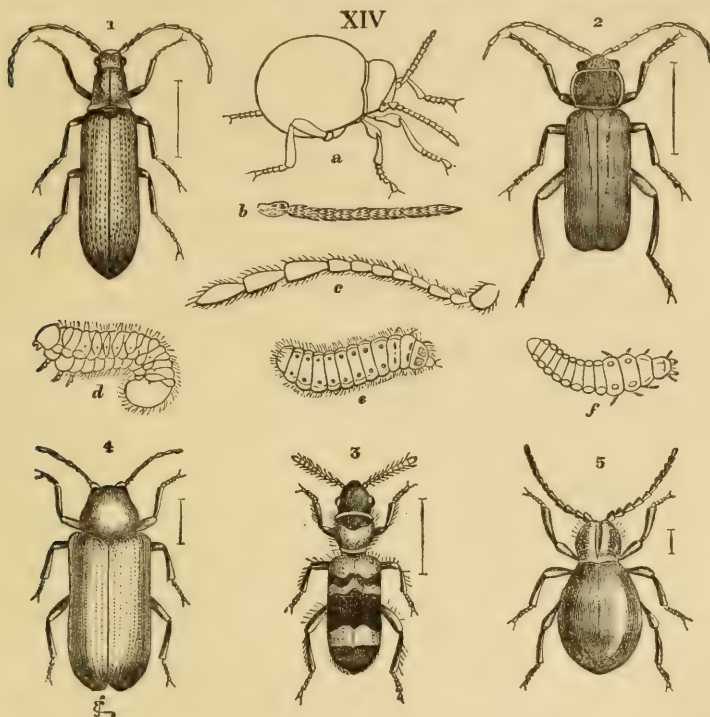
On Woodcut XIII. Fig. *e*, is drawn the larva of this species, which some of my readers will probably recognise as the WIRE-WORM. The fact is, there are many Wire-worms, the larvæ of several species of Skipjack Beetles being called by this convenient name. They are termed Wire-worms for two reasons—first, because they are long and narrow, seeming to be drawn out, as it were, like wire; and, secondly, because they are tough and hard-skinned, so that a roller passing over them does them no manner of harm, but only squeezes them into the soil, as if they were so many pieces of wire.

Some of these larvæ commit terrible ravages among the crops, feeding upon the roots, and so remaining themselves hidden while their ravenous jaws are destroying the very life of the plants. There are few things which irritate an agriculturist more than such a foe as this. He makes up his mind to the caterpillar, the turnip-fly, the snail, and other creatures which devour the plant itself. They at least can be seen while eating, however closely they may conceal themselves at other times, and the amount of food which they take is proportionate to the mischief which they do. But the Wire-worm wastes and eats in concealment, and, while it only eats one-tenth the amount of that consumed by a caterpillar of equal size, destroys ten times the number of plants. Various projects have been set on foot for extirpating the Wire-worm, but I hear of no plan that has succeeded except that provided by Nature, namely, the fondness of certain birds for the Wire-worm. Mr. Westwood mentions that even pheasants are useful to the farmer in this respect, their crops having been found stuffed with Wire-worms. There are very few plants or flowers which this voracious insect will not attack, and the gardener as well as the farmer is therefore interested in the Skipjack Beetles and their progeny.

The mole is a great eater of Wire-worms, as it finds them near the surface, and can take them while making the superficial burrows which it often excavates within an inch or two of the surface of the ground. It is stated that this destructive larva remains five years in the ground before assuming the pupal stage, so that we ought to encourage as far as possible every creature which assists in keeping down its numbers.

Our last example of these insects is that which is represented on Woodcut XIV. Fig. 1, and is known by the name of *Campylus linearis*.

As the reader may see by reference to the figure, this insect is very unlike any of the Beetles of this group which have been already described. The head projects boldly from the thorax, and the eyes are very large. The hinder angles of the



1. *Campylus linearis*. 2. *Telephorus fuscus*. 3. *Clerus formicarius*. 4. *Anobium striatum*. 5. *Mezium sulcatum*. a. *Mezium*, side view. b. *Mezium*, antenna. c. *Anobium*, antenna. d. *Anobium*, larva. e. *Clerus*, larva. f. *Telephorus*, larva.

thorax are rather elevated, sharp, and bent outwardly. The body is long and slender, a fact which has gained for the insect the specific title of *linearis*. The generic title *Campylus* is of Greek origin, the word signifying a peculiar staff; and the name has been chosen on account of the slender, stick-like form of the insect.

This is an extremely variable species in point of colour,

the female being very remarkable in this respect. Red, however, is the leading colour, and the average hues of the insect may be described as follows:—The head is black and deeply punctured, and the thorax has a deep furrow along the centre, and a transverse pit or ‘impression’ a little behind the middle. Its colour is brick-red, and in many specimens there is a black spot on the centre, while in others the same part is brown. The elytra are rather more convex in the female than in the opposite sex, and are covered with striæ and punctures. Their colour is somewhat the same as that of the thorax, but rather paler, though in many examples, especially among the females, the whole elytra are yellowish-brown except the margin, which retains the ordinary brick-red colour.

The insect is a plentiful one, especially in certain years. It is best taken by means of the sweep-net, which should be used along the sides of hedges, in copses, and similar localities. It is the only British example of its genus.

CHAPTER IX.

MALACODERMI.

IN this group of Beetles are gathered together a number of Beetles differing much from each other in many points, but agreeing in the one characteristic which has gained for them the name of MALACODERMI, or Soft-skinned Beetles. In these insects the exterior of the body, instead of being quite hard and strong, as is the case with those Beetles which we have examined, is soft and flexible, and generally covered with a very short and delicate down.

We begin our notice of these Beetles with the family of the Lampyridæ, of which only one species inhabits England, namely, the well-known GLOW-WORM (*Lampyris noctiluca*). In this family, the female possesses neither wings nor elytra, the head is concealed under the large and rounded prothorax, and both sexes have the power of emitting a phosphorescent light, the lamp of the female being very much brighter than that of her mate.

This, almost our sole representative of the exotic light-giving insects, is fortunately very plentiful in this country, and may be seen abundantly in sheltered spots, preferring those which are slightly damp. It is very abundant in Kent, and in the summer evenings the green-blue lamp of the Glow-worm may be seen shining amid the leaves. If examined in the dark, the light is seen to proceed from the three last segments of the body, the under side of which emits the light in a wavering, uncertain sort of way, the fact of being handled seeming to alarm the insect and cause it to retain the light-giving power. Sometimes, indeed, it puts out its lamp altogether when handled, the light being evidently under the control of the insect. It is said, however, that if a Glow-worm be placed in oxygen gas the light is greatly intensified, and the Beetle

seems unable or unwilling to retain it. Gilbert White, in his 'Selborne,' remarks that the Glow-worms put out their lamps between eleven and twelve at night, and shone no more for the rest of the night.

Both sexes of the Glow-worm are represented on Plate VI., the male at Fig. 1, and the female on his right at Fig. 2. The dissimilarity between the sexes is very strongly marked, the female being entirely wingless, while the male has large wings, and elytra which cover the whole of the body. It is popularly thought that the male does not possess the light-giving power; but this is a mistake, as every practical entomologist must know. Still, though the male does possess a lamp, it is very much smaller and feebler than that of the female, and, instead of a mass of phosphorescence, throwing a radiance of some inches in extent, it is nothing more than two tiny spots of light, no larger than minnikin pins' heads. I once took a male Glow-worm on the wing with his lamps lighted.

As to the object of the light, it is a matter of very great uncertainty. The obvious solution of the problem is to say that the light is intended to guide the male to his mate; and if the naturalist be a classical scholar, he will be sure to make an allusion to Hero and Leander—

The chilling night-dews fall—away, retire;
For see, the Glow-worm lights her amorous fire!
Thus, ere night's veil had half obscured the sky,
The impatient damsel hangs her lamp on high:
True to the signal, by love's meteor led,
Leander hastened to his Hero's bed.

These lines, even though written by so acute a naturalist as Gilbert White, are more poetical than true. I cannot of course say that the light of the female may not act as a guide to her mate, but I cannot see that this is the object of the light. There are plenty of night-flying insects which manage to find their mates in the dark without the use of any such aid, being attracted to them by scent rather than sight; and, even if the light emitted by the female Glow-worm be intended for such a purpose, that of the male cannot be of the slightest use either to him or to the mate whom he is seeking.

Moreover, not only the perfect insects, but the pupæ, the larvæ, and even the eggs are slightly luminous, so that in these

cases the light evidently cannot act as a guide. I am inclined to believe that no utilitarian theory will account for this singular development of light from a living insect, and that the phosphorescence was given to it for the same reason that the butterfly's wing glows with many-coloured plumage, and the rose is dowered with softly-tinted petals and sweet perfume.

This insect is doubly interesting to the entomologist. In the first place, it is a British light-producer; and in the second, its life in the larval state is a very valuable one to the agriculturist. It feeds on snails, attacking and devouring them while still alive, their shells being no protection to the luckless molluscs. The structure of this larva is rather remarkable. In the first place, it bears a singularly close resemblance to the perfect female insect; and in the next, it is furnished with a peculiar apparatus at the end of the tail, which serves a double purpose, primarily of assisting in locomotion, and secondarily acting as a brush, by which the slime of the snail can be swept from its body. In some works on entomology, this organ has been erroneously drawn like a shaving-brush cut off square at the end, whereas it consists of some seven or eight projections from the end of the body, which can be protruded or withdrawn at will. Almost as soon as the snails begin to come out from the hiding-places in which they have lain dormant through the winter, the Glow-worm larva is ready to attack them, and thus plays its part in reducing the number of snails that would have been produced by those which it kills, and so helping to preserve the balance of Nature.

It remains in the larval state until April or May, according to the warmth of the weather, and then changes into a pupa, the male and female forms being then very distinct, as the former exhibits the rudiments of the elytra, while the latter remains as wingless as in the larval state. After the lapse of a fortnight or a little more, the pupal envelope bursts, and the perfect Beetle makes its appearance. The generic name of *Lampyrus* is formed from two Greek words, signifying 'shining-tail.'

In the little Beetle known by the name of *Drilus flavescens*, we have another of the many unknown benefactors of the agriculturist and gardeners. A portrait of this insect is given

on Woodcut XV*. Fig. 4, enlarged about two and a half diameters, so as to show the peculiarities of its structure.

The genus is distinguished by several points of structure. The antennæ of the male are beautifully and deeply pectinated, the pectination being on the inner side only of the antennæ. The head projects boldly from the thorax, thus differing greatly from the preceding insect, and the ends of the mandibles are two-notched. The body is rather long and moderately convex. The ground colour of this insect is black, but when it is in good condition, it is thickly covered with yellowish-grey down, which has a sort of rich velvet-like aspect. The elytra are also covered with down, and are very soft.

This description applies only to the male Beetle, the female being so utterly unlike her mate, that few persons, even if they had some acquaintance with entomology, would believe her to be the female of the pretty little Beetle which has just been described. Indeed, for a long time the two sexes were regarded as two distinct insects, belonging even to different genera, the male retaining the name of *Drilus*, and the female being described under the title of *Cochleoctonus vorax*. The name was appropriate enough, inasmuch as the word *Cochleoctonus* signifies 'snail-killer,' and the specific name *vorax* was given in allusion to its voracity.

It is really no wonder that creatures so different in appearance should be looked upon as two distinct insects. In the first place, the female is inordinately larger than her mate, who looks by her side—to borrow Reaumur's simile—like a hare standing by a cow. A figure of the female is given on Woodcut XV*. Fig. 3, where she is represented of the natural size, i.e. about three-quarters of an inch in length. Now, the male *Drilus* seldom exceeds one-quarter of an inch in length, and often is below that measurement. Like the female glow-worm, she is entirely wingless, but is more cylindric than that insect, and the body is narrowed in front. The colour is reddish-yellow, and each segment has two dark patches on the upper side. Altogether, she is not a pretty insect—indeed, she may almost be called ugly; and how the slender, elegant little male finds any attraction in such a huge, awkward-looking mate, does certainly seem wonderful.

The larva is very much like the female, but has a row of

conical fleshy lobes along the sides, and two rows of hairy bunches on its back. At the end of the tail is a forked lobe, which, like the similar part of the glow-worm larva, is used as a means of locomotion. It is by these lobes and bunches that the larva is enabled to force its way into the snails on which it feeds. This larva is but seldom seen, as it lives throughout its entire larval and pupal existence within the shell of the snail, and the skin, which it casts preparatory to changing into the pupal state, exactly fills up the entrance of the shell.

The male Beetle is widely spread over England, but is seldom captured except by skilled insect-hunters, while the female is so rare that many entomologists, who have taken the male *Drilus* repeatedly, have never even seen the female.

The following account of the capture of one of these Beetles is given by Mr. E. C. Rye:—‘I once took, at the base of Shakespeare’s Cliff, a full-grown female larva, running rapidly in the hot sunshine among snail-shells. It was more than half an inch long; flat, narrow, but rather widening behind; with a flat head, armed with two sharp and rather widely-separated mandibles; six moderately long anterior legs, ten thin tubercles on each side of the fourth and following segments, gradually getting longer, and clothed with stout brown bristles; and two longer elevated protuberances, also set with long hairs on the upper side, with an oval elongation beneath, on the last segment. It was nearly the colour of raw sienna, and had a widening row of black spots on each side, beginning on the thorax.’

There is but one British species of this genus.

THE family of the Telephoridæ comes next in order. These insects have long and very soft elytra, which often do not cover the whole of the abdomen. The head is not hidden under the thorax, and both the antennæ and the palpi are slender. The various species are very plentiful, especially on the flowers of umbelliferous plants, and are popularly known as Soldiers and Sailors—the red species being called by the former name, and the blue species by the latter.

One of these Beetles, called *Telephorus fuscus*, is shown on Woodcut XIV. Fig. 2. In this genus the elytra reach to the end of the abdomen, and the thorax is not notched. Soft-

bodied as are these Beetles, they are among the most quarrelsome of insects, and fight to the death on the least provocation. Indeed, it has long been the custom for boys to catch these Beetles, and set them fighting with each other. There is not the least difficulty in this, inasmuch as the Beetle is as ready for battle as a game-cock, and, not content with fighting to the death, eats its vanquished antagonist after killing it. The popular idea among boys used to be, that a soldier and a sailor must be pitted against each other; but this is not the case, for these Beetles will fight and devour each other without the least reference to species or even to sex, so that a soldier male and female will fight as fiercely as if they were two males of different species.

They are not active insects, and though they can fly well, and use their wings freely, are slow of progress, and can be taken by hand while in the air. The larva of the *Telephorus* is represented on Woodcut XIV. Fig. f. Like the perfect insect, it is carnivorous, feeding generally upon earth-worms, but having no scruple in devouring its own kind. These larvæ may be found among grass and moss during the earlier months of the year, after the severe frosts have ceased. They pass the whole of the winter in the larval state, and assume the pupal condition about April or May, according to the warmth of the season. Twenty-two species of *Telephorus* are indigenous to England.

THE family of the Cleridæ are mostly beautiful insects, and, although they are not large, some of them may rank among our prettiest Beetles. The body is oblong, hard, and covered with down, and the head and thorax are not as wide as the elytra. The genus *Clerus* is known by several points of structure. The basal joint of the tarsus is very minute, the last joint of the labial palpi is hatchet-shaped, and the last joint of the antennæ is large, rounded, and furnished with a curious projecting point directed inwards.

In their larval state these Beetles are carnivorous and parasitic on other insects. We shall take two examples of this pretty genus, the first of which is *Clerus formicarius*, which is shown on Woodcut XIV. Fig. 3. The head of this insect is black, and the thorax brick-red, the front margin being black.

The elytra are very boldly coloured, their ground hue being black crossed by two snow-white bands, shaped as seen in the illustration, and their base is of the same colour as the thorax. The larva, which is shown at Fig. *e*, is found under the bark of trees, not to eat the wood or bark, but to destroy and feed upon the larvæ of wood-boring Beetles. Its colour is dark-pink, spotted in front. The specific name of *formicarius* is given to this Beetle because it has an ant-like aspect.

Another species, *Clerus apiarius*, is represented on Woodcut XV*. Fig. 2. This is very differently coloured from the preceding species. It has the head and thorax deep-blue, and the elytra red, crossed with three blue bands. The larva of this insect is parasitic on bees, preferring the comb of the hive-bee, in which it is very mischievous, devouring not only one larva, as is generally the case with such parasites, but several in succession, creeping for the purpose from one cell to the other. We may call it the HIVE BEETLE.

The name of *Clerus* was given by Aristotle, in his 'History of Animals,' to a destructive insect that did much harm in beehives, and it has therefore been appropriated to these Beetles. It is very likely, however, that the *Clerus* of Aristotle was really the larva of the Honey-moth (*Galleria*), too familiar to all bee-keepers. This is the more likely, because the Honey-moth is very common, and the Beetle is always a scarce insect. There is another species, *Clerus alvearius*, which inhabits the nests of solitary bees, such as those belonging to the genera *Osmia* and *Megachile*. All the species form cocoons when they are about to pass into the pupal state; and after they have attained their perfect form, they can walk boldly into the open air, even the stings of the hive-bee being of no avail against the hard armour of the Beetle.

THE reader will remember that the larva of the first example of the Cleridæ feeds on those of certain wood-boring Beetles. We now come to one of the insects which furnishes unwilling nourishment to the *Clerus*. It is represented on Woodcut XIV. Fig. 4, and is called *Anobium striatum*. This Beetle belongs to the family of the Ptinidæ, a group of small and very destructive Beetles. They are cylindrical in shape, covered with very short down, and are able to draw their heads completely

under the overhanging thorax. Their legs can be packed closely to the body, and the tarsi have five joints. The genus *Anobium*, of which there are eleven British species, has the three last joints of the antennæ rather longer than the others, and the last joint egg-shaped.

The various species of this genus work terrible havoc among furniture, in which they produce the defect that is popularly known by the name of 'worm-eaten.' They are not in the least particular as to their diet, and will devour almost any kind of food. They seem to have a special appetite for weapons and implements made by savages, as I know to my proper cost, sundry Kaffir articles being absolutely riddled with the burrows of these tiny Beetles, and not to be handled without pouring out a shower of yellow dust, caused by the ravages of the larva. The most complete wreck which they made was that of a New Guinea bow, which was channelled from end to end by them, and in many places they had left scarcely anything but a very thin shell of wood.

In such cases I have but one remedy, namely, injecting into the holes spirits of wine in which corrosive sublimate has been dissolved. This is not so tedious a business as it may seem to be, as the spirit will often find its way from one hole to another, so that, if half a dozen holes be judiciously selected, the poison will penetrate the whole piece of wood, kill all the insect inhabitants, and render it for ever impervious to their attack. The above-mentioned bow cost me but little trouble. I first shook out the greater part of the yellow powder, and then, placing the bow perpendicularly, injected the spirit into several holes at the upper end. The effect was magical. The little Beetles came out of the holes in all directions, and not one survived the touch of the poisoned spirit; many of them, indeed, dying before they could force themselves completely out of the holes. They will also eat skins and any dried animal substance; and I have found a neglected box of moths completely eaten by these voracious insects.

The present species is rather convex, and blackish-brown in colour. The thorax is rather narrowed behind, and on each side of the hinder margin are two pits. The elytra are boldly striated, each stria being seen, when examined with the aid of a lens, to consist of a number of punctures placed in regular

rows. It is a very common species. The larva of this destructive insect is drawn, much magnified, at Fig. *d*, and the antenna at *c*.

The old popular terror respecting the Death-watch is well-known, a mysterious ticking being heard in the dead of night, which was—and is still—supposed to presage the approaching death of some one in the house. The ticking of the Death-watch is, in fact, the call of the *Anobium* to its mate, and, as the insect is always found in old wood, it is very evident why the Death-watch is always heard in old houses. There is, by the way, a species of cockroach which acts in a similar manner, and generally disports itself on board ship, where the sailors know it by the name of Drummer.

OUR last example of this group is represented on Woodcut XIV. Figs. 5 and *a*, the latter showing the profile of the insect, whose name is *Mezium sulcatum*. There are three insects very closely resembling each other, belonging respectively to the genera *Mezium*, *Gibbium*, and *Niptus*, each being the sole British representative of its genus. The two former are almost exactly alike, but can be distinguished by looking at the thorax with a lens, the difference being that in *Gibbium* the thorax is smooth, whereas in *Mezium* it is covered with longitudinal furrows, whence the name *sulcatum*, or ‘furrowed.’

To my mind, these are the oddest-looking Beetles that we have in England, and, indeed, at first sight they much more resemble spiders than Beetles. Their bodies are globular, and covered with pale golden down of a silky or satiny lustre. When the insect is placed under a moderate microscopic power—say about thirty diameters—it is seen to be clothed with a double set of hairs, i.e. a thin, soft down lying flat to the body with the points of the hairs directed backwards, and mixed with a quantity of stiff and rather curved bristles, set in regular rows over the surface. In those places where the Beetle has been roughly handled, both the down and the bristles fall off, showing the ground colour of the elytra beneath, which is a dark chocolate-brown. These Beetles have no wings, and the head is quite under the thorax, which, being globular and apparently bearing the antennæ, is often mistaken for the head

itself. The relative position of the head and thorax can be seen by reference to Fig. *a*. There are no wings.

The *Mezium* can generally be found in the cupboards and other recesses of old houses, and, indeed, all three Beetles may be captured on the same premises. A very good trap for them is a deep and steep-sided basin, with a little moist sugar at the bottom, and a stick or two laid against the sides by way of a ladder. The *Mezium* is very fond of sugar, gets up the ladder, lets itself tumble into the sugar, and then cannot get out again, not being able to cling to the polished sides of the basin. It is thought by many entomologists, that neither of these Beetles is indigenous, but that all three have been imported from abroad.

CHAPTER X.

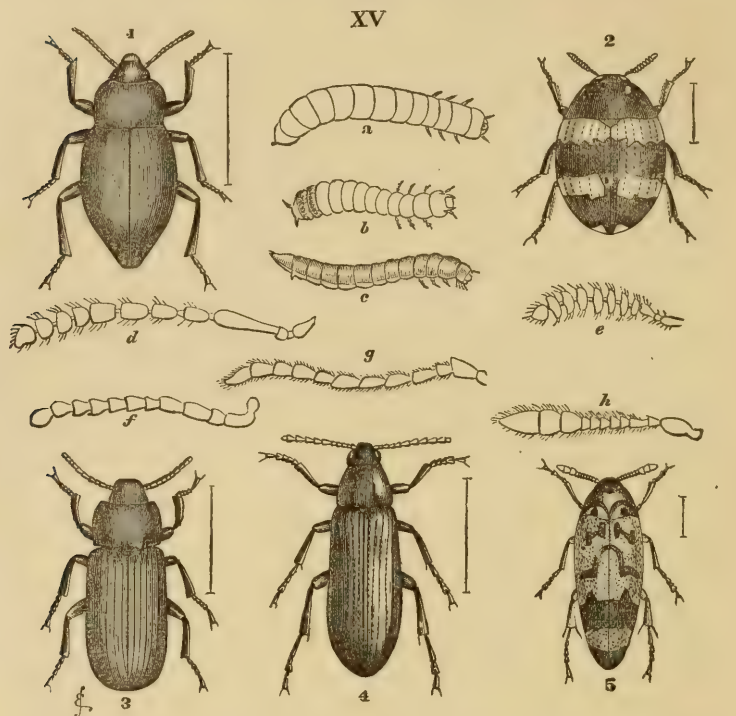
HETEROMERA.

THIS is a very important section of the Coleoptera, embracing many of our most familiar Beetles, though in England the number of Heteromerous Beetles is very small when compared with the list of exotic insects. The name *Heteromera* is compounded of two Greek words, signifying 'unequal-jointed,' and is applied to these Beetles because they all have five joints in the tarsi of the first and intermediate pairs of legs, and only four joints in those of the hinder pair. As has been mentioned in connection with other four-jointed tarsi, the full number of five joints is in reality present, but the basal joint is very long, and in it is merged the missing joint; so that the joint is in reality not absent, but so small as to escape ordinary observation.

The reader may object that many other Beetles are possessed of this characteristic. So they are, but, nevertheless, the distinction is a good one. In the first place, the missing joint in other Beetles is merged in the last and not in the basal joint; in the next place, the true *Heteromera* have the eyes kidney-shaped, and not projecting far from the head; the antennæ are 'moniliform,' i.e. looking like a row of beads on a string, and the mandibles are notched at their tips.

The first family of this section is named Blaptidæ, and its members are known by the 'securiform,' or hatchet-shaped last joint of the maxillary palpi, and the long femora of the hind legs. The wings are not developed, and the elytra are soldered together. In England we only have one genus of this family, containing three species. That which we will take as our type is the CHURCHYARD BEETLE (*Blaps mortisaga*), which is represented on Woodcut XV. Fig. 1, the antenna being shown at Fig. d, below the insect. All the species belonging to this

genus are—to use a word which I do not like to apply to insects—ugly. They are dull, dead-black in colour, are wonderfully sluggish, crawling slowly as if afflicted with rheumatism, and always frequenting damp, dark, and dismal places. Being often found in the murkiest crannies of cellars, they have gained the popular and appropriate title of CELLAR BEETLES.



1. *Blaps mortisaga*. 2. *Diaperis boleti*. 3. *Tenebrio molitor*. 4. *Melandrya caraboides*.
 5. *Orchesia undulata*. a. *Blaps*, larva. b. *Melandrya*, larva. c. *Tenebrio*, larva.
 d. *Blaps*, antenna. e. *Diaperis*, antenna. f. *Tenebrio*, antenna. g. *Melandrya*, antenna.
 h. *Orchesia*, antenna.

The species represented in the illustration may be recognised by the bold puncturing and contracted base of the thorax, and the lengthened projection at the apex of the elytra. It is not so generally plentiful as the second species, *Blaps mucronata*, being seldom found in the southern parts of England. Still these species are very similar in their habits. They are possessed of a very nauseous odour, suggestive of dwelling

among the graves. Yet, unpleasant as these Beetles may be, we are informed that an Egyptian species, *Blaps sulcata*, is employed as a remedy for ear-ache, and a cure for the sting of the scorpion; while the women are in the habit of seeking and eating it, in order to produce the fatness which is thought in the East to be an essential point in female beauty.

This Beetle is singularly tenacious of life, having been known to revive after having been immersed in spirits of wine for a whole night. However, it cannot withstand boiling water, and instantaneously dies when immersed in it. The Beetle-hunter will always find that boiling water affords the most merciful way of killing the larger Beetles. As all the nervous system runs along the under side of the body, the Beetle should be plunged into the water with its legs downwards, and the consequence is that the action of the heat instantly destroys both sensation and life. Care must, however, be taken that the water is absolutely boiling, and the Beetle must not be allowed to remain in it, or it will fall to pieces. The best way is to seize the insect by a pair of forceps, to plunge it quickly into the water, and then to withdraw it.

The larva of the *Blaps* is represented on Woodcut XV. Fig. a, and is very much like the common meal-worm.

PASSING over several families, we come to the Diaperidæ, which are smooth, shining, and brightly-coloured. In general form and colour they very much resemble the Chrysomelidæ (which will be presently described), but may be at once distinguished from them by the tarsi of the first pair of legs having five joints, whereas the Chrysomelidæ have only four visible joints to these members.

The typical genus, from which our example is taken, is distinguished by the basal joint of the hind tarsi, which is short, whereas it is long in the other genera. The pretty little *Diaperis boleti* is shown on Woodcut XV. Fig. 2, and one of its antennæ at Fig. e. This is a boldly-coloured insect, its body being shining-black, crossed on the elytra by two yellow bands, one near the base of the elytra, and the other rather beyond the middle. It derives its specific name from the fact that in the larval state it is a fungus-eater, feeding on several of the boleti which grow on the trunks of trees. It is remarkable for

possessing no eyes. Before it changes into the perfect form it scoops for itself a cell, and then lines it with silk, so as to form it into a cocoon. This is one of the very rarest British insects, and is the only species of its genus.

THE family of the Tenebrionidæ only contains one genus, and that genus but two British species. These Beetles possess large wings, and are capable of flight, the elytra not being soldered together as is the case with the Blaptidæ. The thorax is squared, and its base is as wide as the base of the elytra.

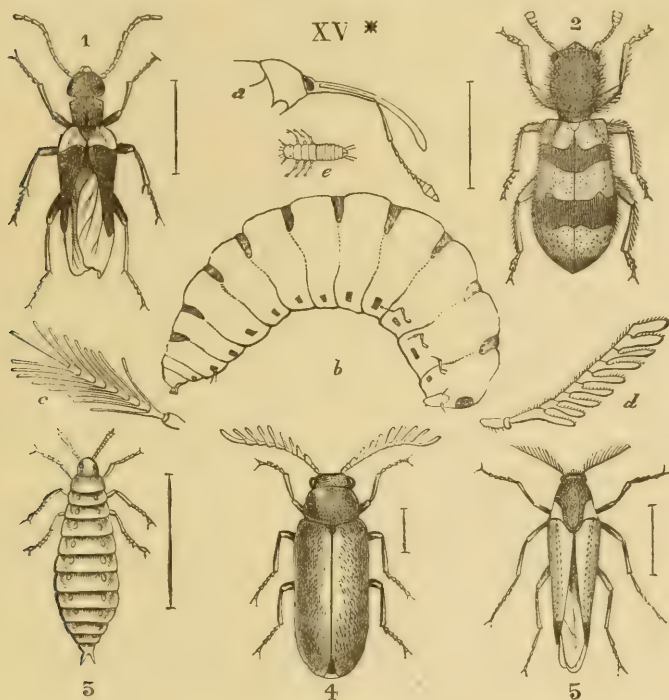
On Woodcut XV. Fig. 3 is drawn the typical British species, *Tenebrio molitor*, and at Fig. *f* on the same woodcut is one of the antennæ. The colour of this Beetle is shining blackish-brown, and the body is rather flat and very thickly punctured. Each of the elytra has one very short stria next to the scutellum, and eight others reaching to the apex. It lives in corn-mills, flour-stores, bakehouses, and similar localities, and in consequence is often called the FLOUR BEETLE. The cream-coloured larva of this insect is shown on the same illustration, Fig. *c*. It is popularly known by the name of MEAL-WORM, under which title it is largely supplied to bird-fanciers, who find that many of their feathered pets will not live unless they have a constant supply of insect food, such as is afforded by the Meal-worm, which, in consequence of the perpetual warmth of its home, breeds throughout the year. From April to June is, however, the best time to find the perfect insect.

The second species, *Tenebrio obscurus*, is quite as plentiful, and so much resembles its congener, that the two are generally confounded together. The latter insect can, however, be distinguished by its colour, which is dull pitchy-black and not shining, and by a number of faint tubercles which stud the interstices between the striæ. The larva of this species is pale-brown instead of cream-colour. Many entomologists think that neither of these insects is indigenous, but that they were both introduced in cargoes of corn or flour.

THE next family in our list is that of the Meandryadæ. These Beetles have small antennæ, and enormously-developed maxillary palpi, the last joint especially, not only being long but very broad. The head is bent down, and sometimes sunk in

the thorax nearly to the eyes, so that it cannot be seen from above.

Our first example of this family is *Orchesia undulata*, which is shown on Woodcut XV. Fig. 5. This genus can be known by the extraordinary length of the spines of the hinder tibiæ, and the antennæ gradually thickening to the tip, as is seen at



1. *Sitaris humeralis*. 2. *Clerus apiarius*. 3. *Drilus flavescens*, female. 4. *Drilus flavescens*, male. 5. *Rhipiphorus paradoxus*. a. *Balaninus nucum*, head. b. *Rhipiphorus*, larva. c. *Rhipiphorus*, antenna, male. d. *Rhipiphorus*, antenna, female. e. *Meloë*, young larva, magnified.

Fig. h. The word *Orchesia* signifies 'jumper,' and is applied to these Beetles because they possess the power of leaping, a power which is exercised in rather a ludicrous way when they are turned out of their homes, skipping and popping about like so many sandhoppers. The head and thorax of this species are rust-red, and on the thorax are two black arches, under each of which is a black dot. The colour of the elytra is yellower than that of

the thorax, and they are crossed with four black belts, as shown in the figure.

These beautiful little insects live in boleti and rotten wood. Of another species, *Orchesia micans*, Mr. Curtis writes as follows:—‘I once found this insect in abundance beneath moist boleti attached to the trunks of elm-trees in Norfolk, in the month of June; and, dropping as soon as the boletus was touched, it became necessary to hold a net beneath, in which they fell and skipped about like shrimps.’ It is probable that the very long spines of the hinder tibiæ afford the means by which these insects leap. The third, and last British species of this genus is *Orchesia minor*.

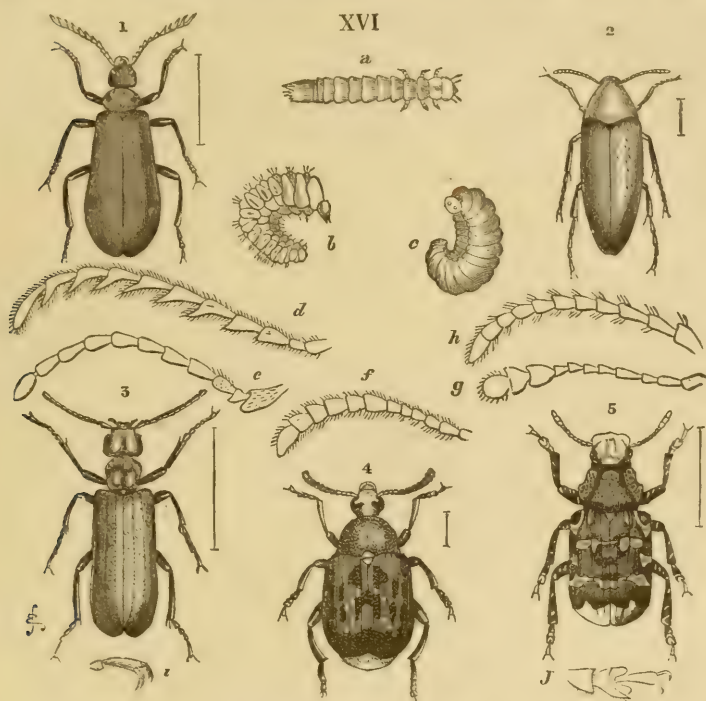
OUR next example, *Melandrya caraboides*, is drawn on Woodcut XV. Fig. 4. In this genus the spines of the hinder tibiæ are not lengthened as in *Orchesia*; the body is long, rather flattened, and slightly narrowed in front. The maxillary palpi have the last joint large and egg-shaped, horny on the outside and fleshy on the inside. The antenna is shown at Fig. *g*.

The colour of this insect is shining blackish-blue, and the body is very flat. The larva, which is shown at Fig. *b*, burrows in old willow-trees, and, by breaking them up, both the larva and perfect Beetle can be obtained at the proper time of year. It is scarcely possible to secure the insect without breaking up the stump, as it usually lives in the burrows made by the larvæ, and retreats into them at the least indication of danger. Sometimes, however, it can be obtained by suddenly tearing off the bark, taking care to place under it a net or sheet of paper, as the Beetles have a habit of tucking up their legs and falling to the ground, when they have no burrows into which they can run. They are winged, and can fly well.

These are not plentiful insects, but the present species is tolerably common, and can be found from March to June. There are only two British species of this genus.

THE family of the Pyrochroidæ is rendered familiar to us by means of the well-known CARDINAL BEETLE (*Pyrochroa coccinea*), so called on account of its beautiful scarlet colour. The insect is represented on Woodcut XVI. Fig. 1.

The Pyrochroidæ are known by the distinct neck, the rounded thorax, and the form of the antennæ, which in the males are boldly toothed, as may be seen at Fig. *d*. The mandibles are deeply notched at the tips, the maxillary palpi have the last joint rather axe-shaped, and the elytra are long, wide, and cover the whole of the abdomen. The typical genus has the



1. *Pyrochroa coccinea*. 2. *Anaspis ruficollis*. 3. *Lytta vesicatoria*. 4. *Bruchus rufimanus*. 5. *Platyrrhinus latirostris*. *a*. *Pyrochroa*, larva. *b*. *Platyrrhinus*, larva. *c*. *Bruchus*, larva. *d*. *Pyrochroa*, antenna. *e*. *Lytta*, antenna. *f*. *Bruchus*, antenna. *g*. *Platyrrhinus*, antenna. *h*. *Anaspis*, antenna. *i*. *Lytta*, claws. *j*. *Platyrrhinus*, tarsus.

antennæ longer than the head and thorax, and very boldly ‘pectinated,’ or comb-like, in the males, in which sex the eyes are distant from each other. ‘Pectination’ is nothing more than a development of ‘serration,’ or saw-like form, each of the joints being drawn out into a long and narrow tooth, sometimes on one side only, but often on both sides. The latter form of pectination is conspicuously shown in many moths, as we shall see when we come to treat of these insects.

The forehead of the Cardinal Beetle is black, and there is a curved rust-red mark between the eyes. The thorax and elytra are rich scarlet, intensified by a short velvety down with which the surface is covered. This insect is as plentiful as it is handsome, and it may be captured throughout the summer. It is often one of the inmates of the sweeping-net, after that implement has been used among the flowers of hedgerows. The larva is shown at Fig. *a* of Woodcut XV. It is whitish in colour, and inhabits decaying willows.

There are two other species of this genus, one of which, *Pyrochroa rubens*, much resembles the preceding insect, but may be distinguished by its head, which is entirely black, and by the scutellum, which is black instead of red.

OF the family of the Mordellidæ we shall take two examples. These are very odd-looking Beetles, and can at once be detected. The front part of the body is very large and deep, and the body rapidly slopes away towards the tail, where it ends almost in a point. The head is bent down, and, when the insect is alarmed, is tucked under the thorax, so that it is hardly visible. The first pair of legs are the shortest, then come the middle pair, the hinder pair being the longest of all. These Beetles are plentiful in the summer, and may be found in any numbers on the flowers of umbelliferæ. The guelder rose is also a favourite flower of theirs. In order to take them, the best plan is to put the net under the flowers, and then tap the flower-stem, when the insects will loosen their hold and fall into the net. They are very active creatures, and in many instances it is a good plan to make a swift, sweeping blow at the flower, so as to cut it off, and leave it, together with its insect inhabitants, in the net.

Our first example is *Anaspis ruficollis*, which is shown on Woodcut XVI. Fig. 2. In this genus the end of the abdomen does not end in a pointed projection, or 'style,' and there is a distinct scutellum; the tarsi of the first and middle pairs of legs have the last joint but one with two lobes, and the hinder tibiæ have long spurs at their tips. The present species is black, but covered with a short dusky down, the thorax taking a warm-yellow tint. The mouth, base of antennæ, and legs are yellowish. This is a tolerably common species, and

is distributed throughout the whole of England. It is to be found in flowers.

WE now come to a very extraordinary Beetle, named *Rhipiphorus paradoxus*. A figure of the insect is given on Woodcut XV*. Fig. 5. In this genus, of which there is only one British species, the head is not visible when the insect is viewed from above, and the antennæ are doubly pectinated in the male and singly in the female. The antennæ of the two sexes are shown on the same woodcut—that of the male at Fig. *b* and of the female at Fig. *c*. The generic name *Rhipiphorus* is formed of two Greek words, signifying ‘fan-bearing,’ and is given to the Beetle in consequence of the fan-like antennæ of the male. The thorax is much arched, and lengthened behind into a point that takes the place of the scutellum. The elytra are not closed throughout their length, but separate at the apex, where they are narrowed into points, the wings extending beyond their tips. The colour of the head is black, and so is the middle of the thorax, the lobe on either side being brick-coloured. There is a bold channel along the middle of the thorax. In the male insect the elytra are yellowish, changing to black at the apex, while in the female they are almost entirely black, with a slight yellow tinge. The abdomen is orange. The female Beetle is rather larger than the male.

So much for the form and colour of this Beetle, and we will now go into its singular history.

Until comparatively late days, this insect was one of our very rarest Beetles, only one or two specimens having been captured, and nothing known of their food or mode of life, this ignorance of their transformations being the reason for the specific name *paradoxus*, or ‘puzzling.’ Accidentally, however, its true habitation was discovered, and since that time it cannot be reckoned among our rarest insects, though the Beetle-hunter is always glad to come on specimens either of the larva, the pupa, or the perfect insect. It is, in fact, one of the parasitic Beetles, taking up its abode in wasps’ nests—a very strange locality, considering its object there, and the terrible weapons with which its involuntary hosts are armed.

Even after it was known that the *Rhipiphorus* was parasitic on the wasp, the insect had still a right to the name *paradoxus*,

for entomologists were undecided as to its food, though they conjectured that, like many, though not all, parasitic Beetles, it fed upon wasps or their larvæ. This question was, however, completely set at rest by the late Mr. S. Stone, in a series of experiments on insects that were parasitic on the bees and wasps. Some of Mr. Stone's extraordinary achievements with these insects will be mentioned in connection with the Hymenoptera. In the 'Proceedings of the Entomological Society,' Jan. 2, 1865, Mr. Stone made a series of valuable communications on this subject, which ought to be given in his own words. After mentioning that he had previously found the pupæ and male and female Beetles, but could not detect a single larva, he proceeds as follows:—

‘On the 19th I was more fortunate, for, on taking out a nest of *V. vulgaris* and proceeding to open the closed-up cells, I found a larva of the parasite firmly attached to the full-grown larva of the wasp; the mouth of the former buried in the body of the latter just below the head; its neck bent over that of its victim, whose body appeared to be tightly compressed by that of its destroyer, showing the latter to be possessed of a considerable amount of muscular power. It was of minute size when discovered, and appeared to have only very recently fastened upon its victim; but so voracious was its appetite, and so rapid its growth, that in the course of the following forty-eight hours it attained its full size, having consumed every particle of its prey with the exception of the skin and mandibles, which, from observations I have since been enabled to make, these creatures retain in their grasp even after they have passed into the pupa state. They scarcely appear to cease eating, except now and then for a minute or so, from the time they first begin to feed till they have become full-grown. The larva is a singular-looking one. The head is bent forward under the body. Between the segments it is more deeply furrowed than any larva with which I am acquainted. A longitudinal furrow extends down the back from the head to the anal extremity, cutting each segment across. The skin, during life, throughout the whole course of this furrow, is perfectly transparent, so that the workings of the internal organs may be plainly seen. The body of the larva, while alive, has the appearance of a thin transparent skin filled with minute par-

ticles of curd. These appearances vanish after death, when the body becomes dense, and has an appearance of solidity about it which it had not before. Several pupæ of the parasite were found in the nest, as well as examples of the perfect insect. It also contained a number of cocoons spun by the larvæ of *Anomalon Vesparum*, with the larvæ still unchanged inside the cocoons.

‘Between the above date and September 3, I took out thirteen more nests of *V. vulgaris*, which contained examples of *Rhipiphorus* either in the larva, pupa, or perfect state. In one which had been destroyed by means of gas tar a few days before I took it out, I was fortunate in discovering a small larva of *Rhipiphorus* firmly attached to its victim. Both were dead and had become partially dried, so that when immersed in spirits they did not separate, but remained attached just as they were before death. These are interesting, because in them may be seen the exact way in which the parasitic larva fastens on its prey. In another which I took out on September 2, I found, on opening some closed-up cells appropriated to queens, one larva and one pupa, which differed in nothing that I could discover from those of *Rhipiphorus* found in the cells of workers, except that they were something like double the size; in fact, about as much larger as the larvæ and pupæ of queen wasps are larger than those of workers.

‘Until the present summer I had not met with a specimen of *Rhipiphorus* since the year 1859, although I had made diligent search for it every succeeding summer. What had become of it all that time, and how it was that all at once it made its appearance in such numbers, are questions more easily asked than answered. Where it occurs it appears to be very local, for I have never met with it, except in one particular part of Cokethorpe Park, within a space of ground about four furlongs in length by two in width. I have searched yearly for it in nests obtained from other parts of the park and the surrounding neighbourhood, but always in vain.’

The reader will remember that the female Beetle is, as a rule, larger than the male. For some years it was taken for granted that the larvæ of the female Beetles fed upon those of female wasps, i.e. the largest larvæ in the largest cells, and thereby obtained their superior development. Mr. Stone, how-

ever, is disposed to take a different view of the case, as will be seen from the following statement:—

‘It is certainly not the fact that female *Rhipiphori* are found exclusively in female cells of wasps, and males in those of workers; for I have bred scores upon scores of both males and females from the cells of workers; nor can I perceive any very great difference in the size of the sexes, although the females are unquestionably somewhat larger, and much more plump in appearance, than the males; still there is nothing approaching the vast disproportion in size which exists between full-grown larvæ found occupying the cells of queens, and those found in the cells of workers. The former must produce specimens of gigantic size.

‘Then there must either be two distinct species, or there must be a permanently large and small variety, the former invariably depositing its eggs in the cells of queens, the latter in those of workers; or, if there is only one species, and no permanent variety of the insect, it must be that the difference in size arises solely from the fact, that some larvæ have been placed, or by a piece of good luck have placed themselves, in a situation in which they have met with an abundant supply of food, thus enabling them to attain the full and proper size, and so produce *Rhipiphorus* as it ought to be; while the others must be looked upon as diminutive examples of the insect, dwarfed and stunted by the limited and insufficient supply of food allotted to the larvæ from which they were produced.’

EVERYONE who has walked in the country, and used his eyes, must have noticed the well-known OIL BEETLES, so called from their curious habit of ejecting a drop of clear yellowish oil from the joints of their legs when they are handled. One of these Beetles, *Meloë cicatricosus*, is shown on Plate VI., the male being represented at Fig. 3, and the female at Fig. 4. The colour of these Beetles is dull, dark indigo-blue, and they are wingless, slow-moving insects, especially the females, so that they have no chance of escaping from capture, to which their very conspicuous shape renders them liable.

The life history of the Oil Beetle is a very curious one. The female Beetle deposits in little holes in the ground a vast

number of the tiniest imaginable yellow eggs, placing several thousands in each hole. As soon as the eggs are hatched, the larvæ make their way into the open air. They are most extraordinary creatures, and no one who saw the newly-hatched and the full-grown larva of this Beetle would ever imagine that they could be the same creature, and in the same stage of metamorphosis. They are scarcely so large as the semicolon (;) used in this work, and are long-bodied, furnished with six long and prehensile legs, and gifted with great activity. A magnified figure of one of these larva is shown on Woodcut XV*. Fig. *e*. As soon as they reach the open air, they climb the stems of flowers and gain the blossoms, where they lie in wait. Presently a bee comes to gather honey or pollen, when the little larva leaves the flower, climbs upon the bee, and clings to its body with its clasping legs.

The bee, unconscious of its new burden, goes as usual to its nest, when the larva quits its hold, and remains in the nest. The parent bee being gone, thinking that everything is right, the Meloë larva devours the egg, and then throws off its first larval form in order to assume another, in which it somewhat resembles the grub of the cockchafer. It now turns its attention to the food prepared by the bee for its young, and finds therein just sufficient nutriment to carry it through its larval condition. One of these larvæ, nearly full-fed, is shown on Plate VI. Fig. 5. The reader will see that it bears not the least resemblance to the long-bodied, quick-legged larva in the first stage of growth.

To prepare these insects for the cabinet requires some little care and patience, especially with the females, for when the creature dies, the large soft abdomen begins to shrink, and when it is quite dry, the abdomen is not one-third its proper size, is full of wrinkles, and crumpled out of all shape. The only plan, therefore, is to stuff it with cotton wool. The usual mode of so doing is, to cut a slit on the under side, remove the contents of the abdomen, and replace them with cotton wool. I have, however, found this plan scarcely satisfactory, inasmuch as the edges of the slit are apt to recede from each other, so that the cotton wool is visible. There is another plan, certainly involving more trouble, but with far better results. With sharp scissors cut off the abdomen altogether, squeeze and draw

out its contents gently by the hole which is made at its base by the blades of the scissors; through the same aperture introduce the cotton wool, a very little at a time, so that you can exactly restore the original shape of the abdomen, taking care to stuff it a trifle larger than it was originally, because the skin will contract a little on the cotton wool. Now, stick the point of a needle perpendicularly into the setting-board, and pass the eye into the abdomen, so as to prevent it from losing shape by lying down. Set the other half of the Beetle independently, and, when both parts are quite dry, join them with a tiny drop of coaguline. If this be properly done, there will not be the slightest mark of any junction, and the specimen will always look as well as it did when living, and preserve its soft, rounded contour.

If ever there were a Beetle which was incapable of fighting, that insect would seem to be the *Meloë*. Yet Mr. F. Smith discovered that it not only could fight, but was ready to fight, and that to the death. He had captured near Margate a number of examples of a rare species called *Meloë rugosus*, as they were crawling near the nest of the bee on which they were parasitic. He put them into a box, thinking no harm of them, but found that on the second day of their captivity a 'free fight' had taken place among them, the result of which was that some were killed and reduced to fragments, the greater number of the survivors had lost either legs or antennæ or both, and out of two dozen Beetles only four escaped without injury. It was difficult to account for this extraordinary development of pugnacity, for the females had already deposited their eggs; so that the *casus belli* was not that which is usual among all the lower animals, insects included, namely, possession of the female.

WE are still among some very strange Beetles, and that of which we now treat is so strange, that for very many years it was not known to be a Beetle, some observers having thought it to be a hymenopterous insect, some taking it for the sole representative of a separate order, under the name of Strepsiptera, but no one discovering that it was in reality a Beetle belonging to the family of the Meloïdæ, a tribe of the Oil Beetles. These insects can be distinguished by the short neck, and by the

peculiar structure of the claws, each of which is furnished with a small supplementary claw on its lower surface.

On Plate XI. the reader will see near the *Andrena* some curious little insects, which evidently do not belong to the order of insects represented on the plate. These are the remarkable insects that have just been mentioned, and which are known by the name of *Stylops Melittæ*. The discovery of the *Stylops* is due to the late Mr. Kirby. He had often observed little projections from between the segments of the abdomen in certain bees belonging to the genus *Andrena*, but thought that they were simply the little mites or acari that beset not only bees but Beetles. He passed a pin under it, and, on trying to disengage it, drew from the body of the bee a little whitish grub, the head of which was projecting from between two of the segments, the whole of its body being buried in the abdomen of the bee.

Being naturally surprised at such a result, he tried another specimen, and this time found that he had hit upon a pupa just ready to cast its envelope. 'The reader may imagine how greatly my astonishment was increased, when, after I had drawn it out but a little way, I saw its skin burst, and a head as black as ink, with large staring eyes, and antennæ consisting of two branches, break forth, and move itself briskly from side to side. It looked like a little imp of darkness just emerged from the infernal regions. I was impatient to become better acquainted with so singular a creature. When it was completely disengaged, and I had secured it from making its escape, I set myself to examine it as closely as possible; and I found, after a careful inquiry, that I had not only got a nondescript, but also an insect of a new genus, whose very order seemed dubious.'

Since that time, much care has been given to the investigation of these insects, and it has been found that several genera inhabit England, the whole constituting the family *Stylopidæ*. The word *Stylops* is Greek, and signifies 'stalk-eyed.' It is given to these insects because some of them have their eyes set on footstalks of greater or lesser length. These are also remarkable for the very few facets which they contain. The compound eyes of most insects may count their facets by thousands, and in many cases by tens of thousands; but in the *Stylopidæ* they are counted only by tens, and in one species,

Elenchus tenuicornis, each compound eye only contains fifteen facets or lenses.

The antennæ are very remarkable, being doubly branched, so that the insect seems to have four antennæ instead of two. These little insects fly well, the second pair of wings being enormously large in proportion to the body, and opening like a wide fan, the anterior and posterior margins reaching to the head and tail of the insect. When flying, the *Stylops* has a peculiar milky look about the wings, not easy to describe, but easily to be recognised when once seen. Wings of such magnitude necessarily require a very large thorax, in order to give support to the muscles which move them; and accordingly we find that the thorax is nearly twice as large as the head and abdomen together, the latter part of the insect looking quite insignificant when compared with the enormous thorax to which it is attached, and of which it almost seems to be an unimportant appendage, instead of being, as it is, the seat of the chiefly vital organs.

As might be expected, the part of the thorax which bears the hind pair of wings, namely, the metathorax, is very largely developed, while that which bears the little attenuated elytra is comparatively small. These members are indeed so small, that they have been called pseudelytra, or false elytra. Many species of bees and wasps are infested with this singular parasite, though the genus *Andrena* seems to be its favourite prey.

WITH two more examples of the *Heteromera*, we close our notice of this group. One is the BLISTER BEETLE or SPANISH FLY (*Lytta vesicatoria*), which is shown on Woodcut XVI. Fig. 3. This insect is well known for its use in medicine, the peculiar substance contained in it being highly inflammatory, and raising blisters upon the human skin. This substance is called cantharidin, and, when separated from the insect which produces it, takes the form of white flat crystals, which can be dissolved in alcohol, but not in water.

This genus is known by the long narrow body and elytra, the two long wings, and the egg-like form of the last joint of the maxillary palpi. The colour of the BLISTER BEETLE is rich-green, mostly glossed with gold or copper. The elytra are very slightly wrinkled, and upon each elytron there are two ridges.

Entomologists believe that this is not an indigenous insect, but has been introduced from the Continent. It occurs much too sparingly in this country to be of any practical use, and our chief supply is obtained from Spain, whence the popular name of Spanish Fly. In England it is usually found in the southern counties, the ash being its favoured tree, and when it is seen at all, it generally occurs in some profusion. Should the Beetle-hunter capture any of these insects, he is advised to be very cautious how he handles them. He should carefully avoid allowing his fingers to come near his eyes, and should wash them as soon as he has finished his task. Indeed, with these Beetles, the less the fingers, and the more the forceps, are used, the better for the operator.

ON Woodcut XV*. Fig. 1, is drawn a very remarkable, and in this country very rare, insect, called *Sitaris muralis*, a Beetle which derives its specific title from the fact that it is parasitic on certain solitary bees which inhabit holes in walls. Bees belonging to the genus *Anthophora* seem to be chiefly the objects of its attacks. On the Continent it is comparatively common, and it is from Continental entomologists that we have received our principal knowledge of the Beetle and its habits.

The Beetle is known by the elytra, which are very long and narrowed to the apex, but do not cross each other. There are two wings, and the antennæ are quite simple, without pectination or serration. The colour of the insect is very plain, the body being black and the elytra yellowish-brown.

The female *Sitaris* acts in some respects like the female *Meloë*, for she deposits her eggs in packets containing several thousands each. She does not, however, lay them in the ground, but places them at the very entrance of the holes in which the bees have taken up their residence. The eggs are hatched, and the little larvæ, which have larger bodies and shorter legs than those of the *Meloë*, enter the nest, and there undergo their transformations.

Mr. Westwood mentions some curious discoveries communicated to him by M. Audouin:—‘In examining the interior of a nest of a large *Anthophora*, very common near Sevres, he detected one of the bee-larvæ in its cell, with the interior of

the body entirely consumed, a thin pellicle only remaining; and from within this bladder-like exuviae he extracted a female *Sitaris*, which had evidently therein undergone its transformation. He did not, however, observe whether the pellicle of the larva or of the pupa of the *Sitaris* was contained within the pellicle of the bee-larva. He subsequently found more specimens of the *Sitaris* at large in the nests of this bee, and observed one of the females, whilst in a state of captivity, deposit her eggs, from which were hatched the minute larvæ.' Mr. Westwood then proceeds to point out the distinctions between the larva of *Meloë* and that of *Sitaris*. The two species of *Anthophora* in which this Beetle is generally found are not natives of England.

CHAPTER XI.

RHYNCHOPHORA, OR WEEVILS.

THESE terribly destructive insects do not attain any great dimensions in England, but they make up for their diminutive size by their enormous numbers. How many species are known to inhabit this country it is impossible to say, as new species—especially those of small size—are continually being added to our lists; but if we say that about five hundred British species are at present known, we shall be very near their number.

The name *Rhynchophora* is formed from two Greek words, signifying ‘snout-bearer,’ and is given to these insects because the head is very much prolonged and narrowed, in some species looking like the long curved beak of the ibis or curlew. The mouth and its accompanying organs are always at the end of this beak, and in some species of Weevils the resemblance to the head and mouth of the Porcupine Ant-eater of Australia is really startling. The name of *Tetramera*, or ‘four-jointed,’ was formerly given to this group, because its members appear to have only four joints in the tarsi. Mr. Westwood, however, with his wonted acuteness, pointed out that there were really five joints, the missing joint being microscopically small, and hidden under the lobes of the third joint. Several of these tarsi may be seen on Woodcut XVII. The three basal joints of the tarsus are always furnished with a thick pad beneath, and may be seen by examining the feet of any of our common Weevils with a pocket-lens.

The antennæ are always set well in front on the ‘rostrum,’ or beak, and in most, though not in all, species are furnished with a very long basal joint, so that they are elbowed, or ‘geniculated,’ according to the scientific term. I shall in this work always use the English forms of such words, provided that they express the same idea as the scientific term, which will,

however, be always explained. For the future, therefore, I shall employ the English word beak instead of the Latin rostrum, and the word elbowed in preference to the Sanscrito-Græco-Latinised-Anglified word geniculated.

According to the system which is at present in vogue, the Weevils are divided into two sections—namely, those in which the antennæ are not elbowed, and those in which they are. The former are called *Orthoceri*, or ‘straight-horned,’ and the latter *Gonatoceri*, or ‘knee-horned.’ We begin with the former, and take for our first example of these Beetles the RED-FOOTED WEEVIL (*Bruchus rufimanus*), which is drawn on Woodcut XVI. Fig. 4, its antennæ being shown at *f*. This insect belongs to the family Bruchidæ, which have antennæ rather serrated, and becoming gradually thicker towards the apex. The elytra do not reach to the end of the abdomen, and the basal joint of the tarsus is long and curved. In the genus *Bruchus* the antennæ are rather delicate, and the elytra are oblong and squared.

The Red-footed Weevil is rather variable both in size and colour, but is usually as follows:—The general hue is black. Upon the thorax, which has its edges slightly waved, there are two white spots upon the disc, and a large triangular spot about the middle of the base, some ashy-white hairs being scattered on the disc. The elytron is striated and punctured, and has a number of white spots scattered over it, and a whitish-grey streak near the scutellum. The tip of the abdomen is white, with the exception of two dun-coloured spots.

All the species of this genus are exceedingly destructive, feeding upon the seeds of beans, peas, and similar vegetables, very often doing enormous damage by dint of numbers, in spite of their small individual size. The reader may perhaps have had occasion to notice that, when peas are newly shelled, one frequently occurs in which a hole or a groove is scooped, and which is tenanted by a little white maggot. These maggots are almost always the larvæ of this or some allied species of Weevil. One of these larvæ is shown, much magnified, on Woodcut XVI. Fig. *c*. They remain in the seeds until they have attained their perfect condition, when they escape through a round hole made for the purpose while in the larval state. Eight species are acknowledged to be in-

digenous to Great Britain. Many other species have been placed on the British lists, but entomologists have decided that they have been introduced into England in cargoes of peas, beans, or corn, and therefore ought not to be admitted as genuine British insects. Indeed, it could be wished that the law of extradition could be extended to insects, and that these Weevils, together with the cockroach and sundry other destructive and noxious insects, could be restored to the country whence they came.

THE family of the Anthribidæ will be represented by one example. This family has also eleven joints in the antennæ, the whole of which is formed of three joints, as is seen at Fig. *g*, and the second joint of the tarsi has two lobes, as shown at Fig. *j*. Our example of this family is *Platyrhinus latirostris*, Woodcut XVI. Fig. 5, and is the only British specimen of its genus. The generic name of this insect, signifying 'broad-nosed,' points out one of the leading peculiarities of this genus, which has the head so wide and short that it scarcely seems to belong to the long-snouted Rhynchophora. In this genus the two basal joints of the antennæ are short, and the club is a very bold and abrupt one, like the knob at the end of a life-preserver. The elytra reach to the end of the body, and the antennæ are longer in the male than in the female.

The present species is oblong in shape, and the general colour is black. The short beak is ashen-white, changing to black at the tip, and the thorax is punctured and boldly wrinkled. The elytra are adorned with rows of punctures, and are black in colour, except towards the apex, on which are two black dots, and in some species two or three little dusky streaks. The abdomen is white, changing to black at the sides, and the legs are black, but have a greyish-white down on them.

This is not a plentiful insect, and requires much searching before it can be found, owing to its dusky colours, and its ingenious mode of selecting such localities as harmonize best with its mottled surface. Heaps of dry sticks, for example, are places where an insect-hunter may expect, if anywhere, to find this Beetle. It also clings to the trunks of ash, alder, and

birch-trees. If, however, one specimen be found, a number will generally reward the collector, for, although it is not widely distributed, it generally occurs plentifully in some favoured locality. The ash-tree is chosen by this Beetle on account of the fungi which grow upon it, and which form its food. When it cannot find a convenient fungus, it is obliged to content itself with burrowing into decaying wood or beneath the dead bark. On Woodcut XVI. Fig. *b*, the larva of this Beetle is shown.

Of the Attelabidæ we shall take two examples, the first belonging to the typical genus, and known by the name of *Attelabus curculionoides*, Woodcut XVII. Fig. 1.

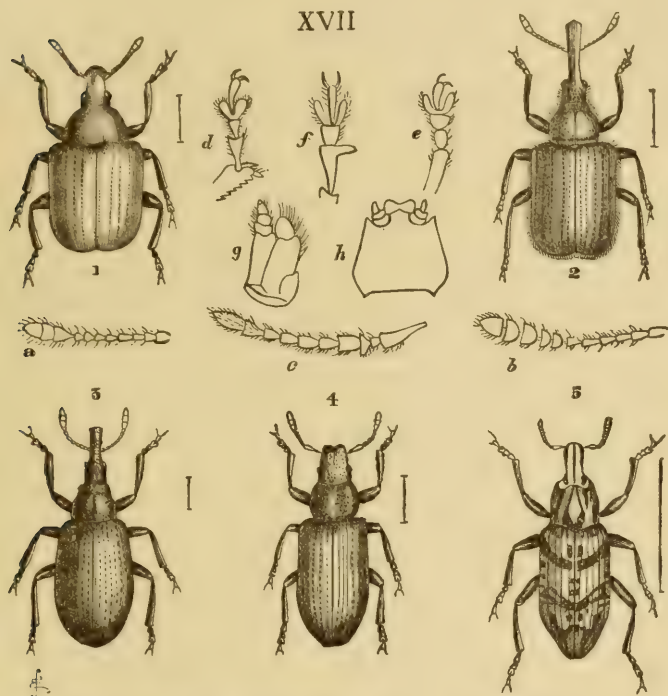
In this family the head is more elongated, and the beak is rather widened towards the end. The antennæ are straight, as may be seen at Fig. *a*, which represents one of the antennæ of the present species. The rather peculiar tarsus is shown at *d*. The elytra do not reach to the end of the body. The genus is known by the broad and rather flattened body, the wide thorax, and the shape of the head, which is not narrowed into a neck behind the eyes, as is the case with *Apoderus*, a genus which otherwise much resembles it, but has a definite neck and a body more flattened.

The present species is very common throughout England, and is a very pretty little Beetle, varying in length from an eighth to a quarter of an inch. The head is black, and slightly wrinkled between the eyes. The thorax is small, very finely punctured, and brick-red in colour, the elytra being of the same hue.

Oak and hazel, especially the underwood, are the best localities for this Beetle, which can best be captured, like many others of its group, by the sweep-net. Sometimes eight or ten specimens will be found in the net after a few minutes' sweeping. The reason for its prevalence in such localities is, that the larva feeds on the young leaves of the oak. Leaves which have been attacked by this insect are very common in oak-copses, and a pocketful can often be obtained in a short time. They are known by being rolled up tightly into a shape which has been well compared to a lady's thimble. To the naked eye, the brick-red of this Beetle looks rather dull, but when

viewed by the aid of a microscope, the surface both of thorax and elytra is seen to possess astonishing beauty, the rich shining-red being broken up into various shades by the rows of punctures.

I have often wondered whether the insects themselves are capable of seeing and admiring these beauties without the aid of



1. *Attelabus curculionoides*. 2. *Rhynchites Bacchus*. 3. *Apion carduorum*. 4. *Sitones lineatus*. 5. *Cleonus nebulosus*. a. *Attelabus*, antenna. b. *Rhynchites*, antenna. c. *Apion*, antenna. d. *Attelabus*, tarsus. e. *Rhynchites*, tarsus. f. *Apion*, tarsus. g. *Rhynchites*, maxillary palpus. h. *Rhynchites*, labium

the microscope, as well as we do with its assistance. When viewing through a lens some tiny and apparently dull-coloured insect, and noticing how magnificently beautiful the colouring really is when we put ourselves under the conditions which enable us to see the many details which were before concealed from us, I cannot but feel that such beauties were surely intended to delight some eyes, and most probably the eyes of its fellows.

Our next example of this family is *Rhynchites Bacchus*, represented on Woodcut XVII. Fig. 2.

The generic name *Rhynchites* is taken from the Greek, and signifies long-nosed, or, to be more accurate but less elegant, 'nosey,' and is given to it on account of the shape of the snout or beak, which is much more lengthened than in either of the preceding Weevils, and forms one of the principal characters of the genus. The other characteristics are, that the beak is more or less widened at the end, that the head is not narrowed into a neck behind the eyes, and that the antennæ have eleven joints. The form of the antennæ is shown at Fig. *b*, that of the tarsus at *e*, the maxillary palpus at *g*, and the labium at *h*. There are seventeen British species belonging to this genus.

Many of the insects of this genus are remarkable for their beauty, their bodies being of all imaginable brilliant colours, and having their brilliancy increased by their metallic gloss. This species is certainly not the least handsome among its splendid brethren, its colour being a rich-red, almost coppery-gold, on which is a long soft down. The thorax is deeply punctured, and the elytra, which are rounded at their tips and rather separated from each other, are as of burnished-copper, sometimes taking a purplish hue. Their surface is covered with very deep and bold punctures, and with a vast number of wrinkles running transversely against them. There is much variation in the colour of this splendid Beetle, which is sometimes greenish and sometimes blue; but, as is the case with many of such Beetles, the exact hue depends very much on the angle at which the light is reflected from them to the eye, green changing to blue, then to purple, and purple to gold, as the insect is turned to one side or the other.

It is a rare insect, but has been taken in Darent Wood. It has also been taken plentifully near Crayford, in Kent, on the blackthorn (*Prunus spinosus*).

THERE is an enormous genus of Weevils, consisting of very tiny species, about as large and somewhat the shape of a note of admiration (!) as here given. Their bodies look very much like pears, the stalk of the fruit representing the beak of the insect. In consequence of this resemblance they have received the generic name of *Apion*, which is a Greek word signifying

a pear. They have also been compared to peg-tops; and, if the peg were curved instead of straight, the resemblance would be almost complete. We will call them Pear Weevils.

The genus *Apion* is an admirable test of an entomologist's zeal. If he can set, examine, and determine the Apions which he will catch in an hour's walk with the sweep-net, there is no doubt about his zeal for entomology, a zeal which the genus *Apion* is admirably calculated to quench. They are all so tiny that a tolerably high power is required for their proper examination, and the pocket-lens must be laid aside in favour of a microscope; and in many instances the colour of the trochanter forms one of the principal characteristics. Then, their bodies are so boldly rounded that only a small portion can come into focus at the same time. The necessity for a high power is seen by the fact that without it the antennæ appear only to have eleven joints, whereas they have in reality twelve, the twelfth being an extremely minute one at the very end of the club. None of this genus possess wings, and the elytra completely cover the abdomen. Along the side of the beak are seen two deep grooves, in which the basal joints of the antennæ can lie; and it is to be noted that in death the antennæ of these Beetles are directed backwards, lying partly in the grooves, so that the tip of the antenna comes close to the junction of the head with the thorax.

In spite of the difficulties which attend the examination of these insects, the entomologist will find his time well bestowed upon them. Independently of other sources of interest, these tiny Beetles are marvellously beautiful. Their colours are exceedingly various, and the richness and perfection of the sculpture which adorns their tiny bodies must be seen to be appreciated. It is as if the very exuberance of creative power had sported with these little creatures, a thousand of which could be contained in a lady's thimble, and yet which bear upon every portion of their bodies a limitless profusion of highly-elaborated ornament. The head and thorax are covered with a multitude of deep impressions, at first seeming as if scattered at random, but in reality disposed with most consummate art; while the elytra baffle all attempts to describe their varied beauty. Agreeing in one point—namely, the bold ridges which run longitudinally along them—they are of

infinite variety in their details, so that a full description of all the species would occupy well-nigh more than the space that can be given to the whole of the Beetle tribe.

I have often thought, when examining these little beings with the microscope, that artists in metals might find in them and other Beetles an exhaustless mine of new and most beautiful patterns; and, indeed, artists, no matter in what department, cannot do better than study the insect tribes, in order to learn many secrets of form and colour.

Tiny as they are, the Apions often do much damage to the agriculturist, many of them living in peas and beans, as has been stated of the *Bruchus*, some boring into the stems or roots of plants, or making a gall-like excrescence on the leaves or twigs. They specially frequent clover, and in a field of this plant, and along the adjoining hedgerows, the entomologist can take sufficient Apions in a morning to give him full employment during the winter months with his microscope. I may here mention that some knowledge of drawing is a potent help in the study of insects; and, indeed, the note-book and pencil should be always at hand. No matter how rude may be the sketch, it is sure to be useful, and has a wonderful power in fixing details in the mind.

On Woodcut XVII. Fig. 3, is shown *Apion carduorum*, being about one-seventh of an inch long, while the generality of Apions are not much more than half that length. The antenna is represented at *c*, and the tarsus at *f*. The head and thorax of this insect are black, with short shining hairs scattered very thinly over the surface. Near the base of the head the antennæ are set upon two rather bold tubercles. The elytra are of a verdigris-green, with a tinge of blue—a colour which is rather common to this genus—and the spaces between the striæ are very flat.

Some eighty British species are known to entomologists, and I would strongly recommend the beginner to lay aside the examination of these little beings until his eye is trained to seizing details by some practice with the larger insects.

The specific name of this insect, *carduorum*, signifies ‘of the thistles,’ and is given because it can be found upon that plant. Indeed, the majority of the Apions are named after the plants which they principally frequent. The reader will

have noticed that I have explained a considerable number of the names of the insects, and that some are left unexplained. The fact is that many names have no explanation. Systematic entomologists, when they find new genera crowding on them, are quite at a loss for suitable names. They can manage pretty well with the specific name, because they can take one of the chief characters which marks the species, and give its synonym in Greek or Latin. But this is not to be done with the generic title, and so they are driven to various expedients—such as calling a new genus after the name of some particular friend, or a favourite child, or perhaps a pet dog or cat. Having exhausted their resources, there yet remains another, which will account for some of the remarkable names which we see in entomological lists. Cut up some paper into small squares, and write upon each of them a letter of the alphabet—a child's toy alphabet will answer still better. Take at random half a dozen letters, taking care to have a vowel or two among them, arrange them on the table, and try if they can be made into a pronounceable word. If not, take some more letters and try again; and when a word is at last formed, there is the generic name ready. If a sort of classical air be thought necessary, all that is required is to add *us* or *um* at the end of it.

WE now come to the Weevils with elbowed antennæ, the first family of which is the Brachyderidæ. In these insects the head is short, wide, and set on the thorax without any separate neck, a peculiarity which has gained for the family the name of *Brachyderidæ*, or 'short-necks.'

Our example of this family is *Sitones lineatus*, which is represented on Woodcut XVII. Fig. 4. This genus is known by the possession of wings, the short beak, and the third joint of the antennæ, which is shorter than the second. About fourteen British species of this genus are acknowledged. The present species is a pretty though not a brilliant insect. The ground colour is black, but the body is clothed above with scales of a warm-brown hue, while the under surface of the body is similarly clothed, but with scales having a silvery lustre. There is a central furrow on the disc of the thorax, and a rather deep impression across its apex. The elytra are

punctured and striated, with white interstices between the striæ. These white lines form the distinguishing characteristic of the species, which is apt to be very variable in other respects.

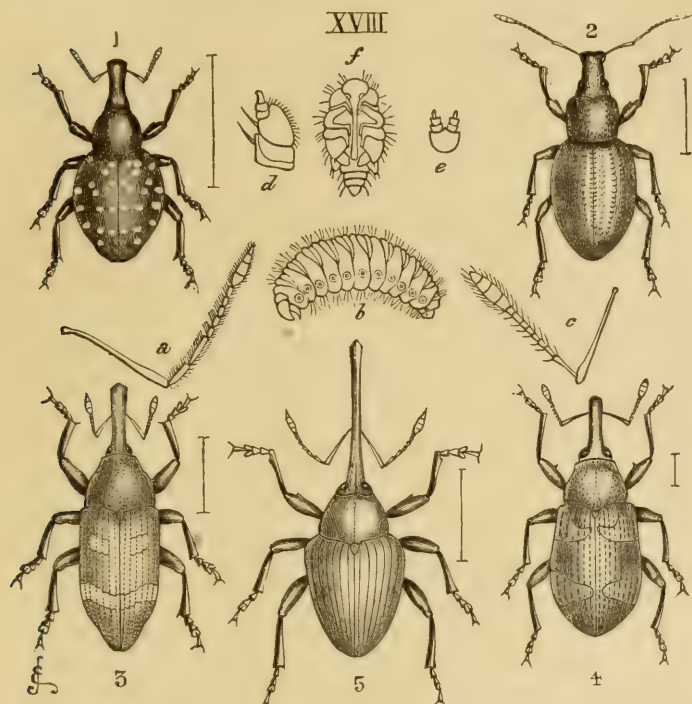
The young entomologist must be very careful in handling this and other scale-clad Weevils, as the scales are easily rubbed off, so that nothing is seen but the dull-black of the elytra. A roughly-handled Weevil is just as unfit for the cabinet as a butterfly with the rich plumage rubbed from its wings.

All the members of this genus are injurious to the crops, especially clover and peas. The generic name of *Sitones* (erroneously spelt *Sitona* by some entomologists) is a Greek word signifying a corn-dealer, and has been given to the Beetles in consequence of their influence upon the harvests.

IN the family of the *Cleonidæ*, which comes next in order, the beak is rather long and strong, and curved downwards in some species with a very sudden bend. In the typical genus the beak is larger than the head, and has the antennæ set near its end. The body is thickly covered with scales, and the tibiæ have a strong spine at the tip. Some of the largest British Weevils are found among the members of this genus, one of which, *Cleonus nebulosus*, is represented on Woodcut XVII. Fig. 5. As may be seen by the line which accompanies the figure, this is quite a large Weevil, sometimes being four-fifths of an inch in length. As is the case with all the members of its genus, its body is covered with scales, which in this species are of an ashen-grey. The beak is also clothed with scales, with the exception of a ridge, or keel, which runs along its centre. The thorax, which has a white streak on each side, is punctured and wrinkled, with a short ridge in the middle, and on each side a number of small tubercles. The elytra are deeply striated and punctated, and have several spots and two distinct bands denuded of scales, as may be seen by reference to the figure. The reader will see from the markings on this insect how necessary is precaution in handling Weevils, as at a very slight touch the scales will fall off, and the distinctive spots and bands be no more distinguished.

These are all very hard-shelled Beetles, and require the use of a needle-point in order to induce the fine entomological pin to pass through their bodies. Their larvæ feed upon the stems

of thistles, in which they may be found. There are four species of this genus, of which one is exceedingly rare, another sufficiently rare to be valuable, while the other two are local, but tolerably plentiful in the places to which they take a fancy. The present species is moderately abundant in the New Forest. The specific name of *nebulosus*, or cloudy, is given to this



1. *Molytes germanus*. 2. *Otiorynchus picipes*. 3. *Pissodes pini*. 4. *Anthonomus pomorum*. 5. *Balaninus nucum*. a. *Otiorynchus*, antenna. b. *Otiorynchus*, larva. c. *Anthonomus*, antenna. d. *Anthonomus*, maxillary palpus. e. *Anthonomus*, labial palpi. f. *Balaninus*, pupa.

Beetle in allusion to the colouring of the body. Like many other Beetles, this species is liable to some variety, the scales of the head and thorax sometimes assuming a red hue, and a line of similar colour running along the suture of the elytra.

ON Woodcut XVIII. Fig. 1, is represented a very fine example of English Weevils. It is called *Molytes germanus*, and is so

conspicuous that it cannot possibly be mistaken if seen. This genus, of which two British species are known, is distinguished by its broad, smooth, egg-shaped body, the minute and scarcely visible scutellum, and the strong hook at the tip of the tarsi. The colour of this species is shining-black, and the thorax is deeply punctured, and marked with three irregular spots on each side, the spots being composed of dull-yellow hairs. The elytra are covered with many dull-yellow spots and a number of shallow rounded impressions.

Both species of *Molytes* are found in chalky districts, and the present species seems to be a very local one, Kent and Sussex being the places where it has chiefly been found.

ANOTHER example of this family may be seen on Plate VI. Fig. 6. This is the Beetle known by the name of *Phytonomus tigrinus*, an insect which is found plentifully at Dover. In this genus the antennæ have twelve joints, the scape being clubbed, and reaching to the eyes, the club being oval. The beak is twice as long as the head, rounded and curved, the elytra are thickly clothed with scales, and the tibiae are without spurs.

The insects of this genus are remarkable for constructing pensile cocoons when they are about to change into the perfect state. One of these cocoons is represented just below the Beetle. These cocoons are really wonderful examples of insect art, and that they should be made by such a creature as a little long-bodied hairy grub seems almost incredible. The form is oval, and the material is silken thread secreted by the insect. The peculiarity in these cocoons is that they are made of open network, the meshes being large enough to admit an ordinary pin. A very good imitation of one of these cocoons could be made by taking some galvanised iron net, and forming it into an egg-like shape; for the threads of the cocoon are in their way quite as strong as the wire. The cocoon represented in the plate is of the natural size.

The larva always takes care to spin its cocoon on the under surface of a leaf, so that it will not be seen unless the leaves be lifted. As a rule, the young entomologist will find that the under surfaces of leaves will often afford him a rich harvest, when no sign of an insect is to be seen on the upper surface.

Fourteen species of this genus are known, and all of them make similar cocoons in which to pass their pupal existence.

These are not the only cocoon-making Weevils, for there is another genus, *Cionus*, which is equally distinguished as an architect. The cocoon of the *Cionus* resembles in every essential that of the *Phytonomus*, but is spherical instead of oval. These insects feed on the mullein; and the best plan to secure the cocoon of the insect is to find out some place where mulleins grow, and search them diligently. The Great Mullein (*Verbascum thapsus*), which grows in waste grounds, on sandy or gravelly soil, is nearly sure to furnish either the Beetle or the cocoon, and perhaps both. Mr. Stephens states that he took all the species of this genus upon a single mullein plant. The Knotted-root Figwort (*Scrophularia nodosa*) is another of their favourite plants. The generic name, *Phytonomus*, is formed from two Greek words, and signifies 'herb-grazer.'

THE next family is that of the Otiiorhynchidæ. This rather crabbed name is compounded of two Greek words, the former signifying an ear and the latter a nose or snout, and is given to this family because the beak is developed at each side into a flat ear-like lobe. The beak is short and stout, and the basal joint of the antennæ reaches beyond the eyes when directed backwards.

Of this family our first example is *Otiiorhynchus picipes*, which is represented on Woodcut XVIII. Fig. 2. The typical genus, to which this insect belongs, has the antennæ long, and generally set on the tip of the beak. The scutellum is often absent, and where it does exist is very small; there are no wings, and the body is egg-shaped and convex. In this genus the ear-like lobes projecting at the tip of the beak, sometimes termed winglets, are very well developed, and can be easily seen with the aid of a magnifier. By these projections there is a deep groove in which the antennæ are set; and in many of the species the head has a most curious resemblance to that of a moose when viewed sideways, the resemblance being increased by the hairs with which the muzzle, if we may so call it, is thickly set.

The insects of this genus are very destructive to plants and fruit-trees, some species attaching themselves more particularly

to definite plants, but the generality being in no wise particular as to the sort of plant, tree, or flower on which they feed. The present species is very plentiful, and prefers young leaves to every other kind of food. This fact shows that it is one of the insects that are found in the spring time, and, by beating whitethorn hedges about April and May, any number can be procured. Although not brightly coloured, it is rather a pretty Beetle. Its colour is chestnut-brown, and the elytra are covered with a thick coating of scales, through which a few stiff and shining bristles project. They are boldly striated, each stria being composed of a series of circular impressions, and between the striæ is a row of elevated, smooth, blackish tubercles. The thorax is very globular and thickly granulated.

The scales which have been just mentioned are found in the members of this family generally, and are most lovely objects when viewed under the microscope. The most beautiful of these scales are to be found on the little green Weevils that are so plentiful upon nettles and hedge-side plants. Seen by the unaided eye, there is nothing remarkable about these insects, which appear to be simple dull-green Beetles; but if one of them be placed under the microscope, and viewed with a half-inch glass with light concentrated on it by a 'bull's-eye' lens, it undergoes a transformation like that of Cinderella when touched by the fairy wand. The whole of its body, head, thorax, and elytra is clad with rounded glittering scales, set in regular order, the scales being larger and fewer on the under side than on the upper side of the thorax. Their colour is gold-green, the latter hue being strongest at their tips, but both colours shifting in accordance with the change of light. The elytra are wonderfully beautiful, for they are boldly and regularly ridged; and as each ridge is densely covered with scales, the play of colour upon them is really wonderful. As if to give more richness to the colouring, the elytra themselves are rich golden-brown, which would be very beautiful even without the clothing of emerald scales, but which are quite thrown into the shade by the beauty of their covering.

Nor do the wonders of the insect cease here. If a still higher power be used, one for example which magnifies some two-hundred diameters, each scale is seen to be shaped with the most elaborate care. The form somewhat resembles that

of a battledore with the handle broken off, and the head rather rounded. The surface is covered with ridges as regular as those of the elytra from which it came, and each ridge projects a little beyond the end of the side, so as to produce a series of teeth. Over the whole of each scale the light plays with a changing lustre, and indeed each tiny scale seems, when greatly magnified, to reproduce in itself the splendid colours of the entire insect.

Several other members of the typical genus are well known to gardeners from the mischief which they do to the flowers and fruits. For example, there is the GROOVED WEEVIL (*Otiorhynchus sulcatus*), which is too plentiful in gardens, and has a peculiar predilection for potted plants, getting just between the root and the stem, and nibbling round the plant until it first weakens, and then destroys it. Owing to the sober-grey exterior of the Beetle, it is enabled to lie concealed on the very spot where it does so much harm; its egg-shaped body, disguised with the particles of earth which cling to its scaled and bristly surface, looking more like a dusty stone than an insect.

The larva of this destructive Beetle was found by Messrs. Westwood and Haworth busily engaged in devouring the roots of a species of *Sedum*, which had been potted. This larva is rather long in proportion to its width, and is covered with short stiff hairs, by means of which it is able to push its way through the earth. It lives but a very little below the surface of the ground, and never eats any portion of the plant that makes its way into the open air, and, as it continues to feed throughout the winter months, does an enormous amount of unsuspected mischief. It changes to the pupa state about May or June, and assumes the perfect form in three or four weeks.

Another of these Beetles is popularly known by the name of APRICOT WEEVIL (*Otiorhynchus tenebricosus*), because it chiefly attacks those fruit-trees which are nailed against the wall, the apricot often suffering direfully from its inroads. This Beetle is pitchy-black and rather shining; and, when examined through a lens, the head, thorax, and elytra are seen to be thickly granulated, while on the elytra are also regular rows of punctures. It may seem strange, but it really is the case that

these striae, composed of tiny punctures, are more apparent to the naked eye than under the lens, which brings out the granulations in bold relief, and throws the punctures into the shade.

If the Beetle be examined sideways and turned gradually round, a narrow line of warm-chestnut appears near the edge of the elytra, always shifting as the body of the insect revolves. When the Beetle is placed under the microscope, and a half-inch power brought to bear on it, this chestnut hue is seen to be occasioned by a number of short reddish bristles, which, when viewed from above, are too few to have any perceptible effect on the pitchy-black of the body; but, when seen in profile, so that a number of them are brought into the field of view, are able to assert themselves and develop their colour. The reader may easily see a parallel case by looking at the back of the hand first from above, and then by viewing it sideways against the light. In the first case the hairs scattered over the surface almost escape observation, while in the latter case they assume quite an important aspect. The bristles of this Beetle, by the way, are easily rubbed off, and therefore the chestnut line is not seen to advantage except in young specimens that have been carefully handled, as is the case with the example from which I write this description.

It is common in hedges, and there does no great harm, but when it takes to invading our orchards, its presence cannot be permitted. It is fond of lurking under the loose bark of grapevines, in the earth around the roots of the fruit-trees, along the bases of the walls, and in old nail-holes. All these places should be searched, the base of the walls well drenched occasionally with tobacco-water, the loose bark stripped from the vines, and the nail-holes stopped with mortar. In the present genus, as now restricted, eighteen British species are acknowledged.

NEXT comes the family of the *Eirirhinidæ*. This name is compounded from two Greek words, which signify 'long-beaked,' and is given to the family because their beaks are of considerable length, nearly as long indeed as the thorax. The first pair of legs are set very close to each other.

On Plate VI. Fig. 7, may be seen one of the Beetles belonging to this family, together with the home in which it

resides while in the larval state. Its name is *Lixus bicolor*. The genus to which this insect belongs is known by its elongated, narrow, cylindrical body, its long and nearly straight beak, and the sharp and strong hook at the end of the tibiæ. This singularly beautiful insect derives its name of *bicolor*, or two-coloured, from the hue of the body, which is clothed with thick scarlet and yellow down. This splendid coat, however, is easily rubbed off, and hence it is difficult to obtain a specimen in really good condition. Thistles and geraniums form the usual habitation of this Beetle, which burrows into the interior of the stem, and there remains until it has undergone its changes. Deal is one of the places where this beautiful Beetle is found; and the best mode of obtaining good specimens is, therefore, to examine carefully the roots and stems of the plants on which it feeds, and if a swelling should appear on any of them, to pull up the plant, take it home, and keep it alive, if possible, until the Beetle makes its appearance. Owing to the extreme delicacy of the downy coat, the laurel-bottle is needed for the various *Lixi*, as, if left to run about in a box or bottle, they would sadly damage their beautiful clothing. Even when the fatal bottle has received them, care should be taken that it be carried steadily, so as to avoid shaking the delicate insect against its sides.

Mr. Hope mentions in his MS. notes that he has taken two species of *Lixus*—namely, *Lixus paraplecticus*, a wonderfully long and thin Beetle, and *Lixus angustatus*—near Oxford, both on flags growing in the Isis.

ON Woodcut XVIII. Fig. 3, is seen a magnified representation of another Beetle belonging to this family. Its name is *Pissodes pini*. This genus has the beak quite as long as the thorax, and the body is egg-shaped, but long in proportion to its diameter. The species which is represented in the illustration is a northern insect, and is found in Scotland, where it is plentiful among fir-trees. It is a handsome Beetle, its colour being rich red-brown, variegated with golden spots.

Mr. Rye describes the habits of this insect in the following words:—‘*Pissodes* . . . frequents pine forests, one species, *Pissodes pini*, abounding in many parts of Scotland, where I have seen the female with her rostrum deeply buried in the soft part

between the outer bark and solid timber of fresh-cut fir-trees. In the hole thus formed an egg is deposited, the larva proceeding from which eats galleries under the bark until it is full-grown, when it closes its retreat with particles of wood, grass, &c., and changes to a pupa. The perfect insects . . . cling very tightly to the fingers when handled.' The name *Pissodes* is formed from a Greek word signifying pitch, and is given to these insects because they inhabit the fir-tree.

THERE is an insect, belonging to the same family, which is too well known to gardeners by the name of APPLE WEEVIL (*Anthonomus pomorum*). Unlike the Weevils which attack the roots and stems of plants, this insect confines itself to the flowers, a circumstance which has caused entomologists to give it and its kin the name of *Anthonomus*, or 'flower-dweller.' In this genus the body is egg-shaped and convex, but rather long, the tibiæ are widened in the middle, and the femora are toothed. The insect is represented on Woodcut XVIII. Fig. 4, the form of the antenna is shown at *c*, the maxillary palpus at *d*, and the labial palpi at *e*.

The colour is brown mottled with chestnut, and on the elytra is a bold white mark much like the letter V. This Beetle may be found in the winter time under the bark of trees, and if touched will at once drop to the ground, where it can hardly be seen. Towards the beginning of March—the time depending much on the state of the weather—the Apple Weevil awakes from its dormant state, and flies abroad in search of a mate. The future proceedings of the insect have been admirably told by Mr. E. Newman, in his 'Letters of Rusticus':—

'By the time the female is ready for the important task of depositing her eggs, the spring has considerably advanced, the apple-buds have burst, and the little bunches of blossom are readily to be distinguished. The Weevil soon finds out these, and, selecting a blossom every way to her mind, commences her operations. The beak or trunk, before alluded to, is furnished at its extremity with short teeth or mandibles: with these she gnaws a very minute hole into the calyx of the future blossom, and continues gnawing until the trunk is plunged in up to her eyes; the trunk is then withdrawn, and the hole examined with careful scrutiny by the introduction of one of her feelers, or outer prongs of her trident. If it seem to require

any alteration, the trunk goes to work again, and again the feelers ; at last, being fully satisfied that the work is well accomplished, she turns about, and, standing with the extremity of her abdomen over the hole, thrusts into it her long ovipositor, an instrument composed of a set of tubes retractile one within the other, and deposits a single egg (never more) in the very centre of the future flower. Another examination with her feelers now takes place ; and when she is thoroughly satisfied that all is right, away she flies to perform the same operation again and again, never tiring while she has an egg to lay.

‘The bud continues to grow like the other buds ; the little perforation becomes invisible. By and by the egg bursts, and out comes a little white maggot, with neither legs nor wings. This maggot, directly it is hatched, begins to devour the young and tender stamens ; next to these the style is attacked, and eaten down to the fruit, the upper part of which is quickly consumed : the maggot is then full-fed ; it casts its skin, becomes a chrysalis, and lies perfectly still. Up to this time the blossom has continued healthy, no trace of the enemy being to be discovered without ; but when the neighbouring blossoms are expanding their petals to the genial breath of spring, those of the mutilated bud remain closed, and retain the arched, balloon-like appearance of a bud about to burst. For a few days they preserve their lovely pink colour, and then, by degrees, fade to dingy-brown. In this state they remain until the other apples are well knit ; and then the damaged blossoms, by their decided contrast, appear very conspicuous. On opening these brown, or rather rust-coloured, blossoms between June 10 and 15, the chrysalis will be found to have changed to a perfect Beetle, similar to its parent, above described, which, had it been left to itself, would in a few days have eaten its way through the weather-beaten case of dried petals and left its prison-house, flying about to take its pleasure, until the chilly winds of autumn should drive it to its winter habitation under the bark.’

The insect also conceals itself under stones, sticks, leaves, or other rubbish lying under the trees, so that the gardener who cares for his fruit-trees will do well to scrape together all these sticks and leaves, and burn them about the beginning of February. Five English species belong to this genus.

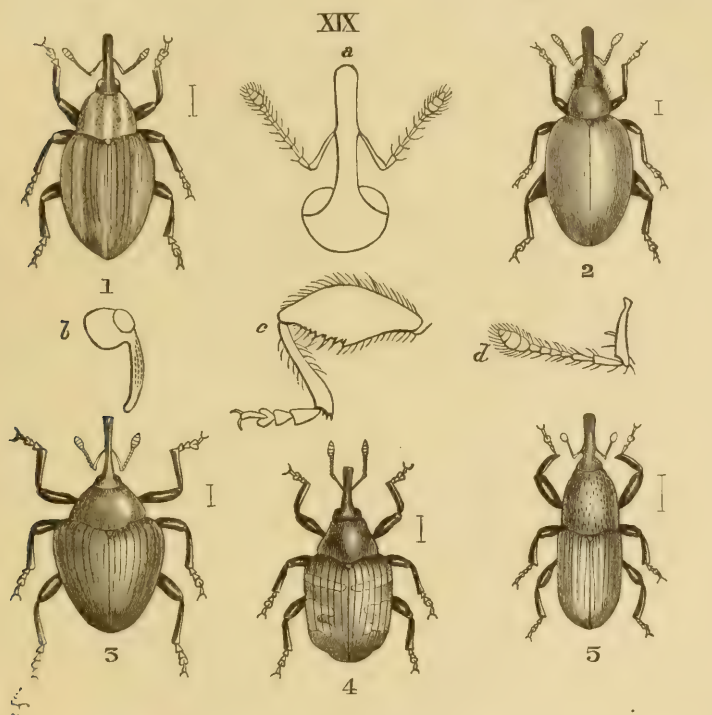
WE now come to a Beetle which has doubtlessly annoyed many of my readers, especially if they should happen to be, or to have been, schoolboys. When cracking a filbert after the primitive fashion, it is by no means pleasant to find the shell of the nut yield sooner than expected, and the mouth filled with a bitter black powder, instead of the richly-flavoured kernel. There are few things nastier in their way than such a nut, and the fault lies entirely with the NUT WEEVIL (*Balaninus nucum*), a figure of which is given on Woodcut XVIII. Fig. 5. This is a very curious Beetle, its beak being as fine as a needle, very long and very much curved, so that the insect, when viewed in profile, looks something like a shoemaker's awl. A much magnified view of the head and beak is given on Woodcut XV*. Fig. *a*.

This genus is at once known by the long and slender beak, which is nearly as long as the triangular body. The antennæ are set in the middle of the beak. The present species is rather prettily coloured. The general colour is soft-brown, but the elytra have a nearly white mark shaped like the letter U, its outlines being defined by two black bands. The scutellum is white. These colours are produced by the clothing of down with which the insect is covered, and when the down is rubbed off, the Beetle becomes nearly black.

The life story of this Beetle is very simple. As soon as the nut blossom has fallen, and the fruit has fairly 'set,' the female Weevil begins her work. She bores a hole into the young and still soft fruit, and in the hole she deposits a single egg, repeating the process until she has disposed of her whole stock of eggs. Her business in life is now finished, and she dies. Meanwhile, the eggs are hatched, and the young larvæ begin to feed on the substance of the nut, carefully avoiding a vital part, so that, to all external appearances, the nut is perfectly sound and good, though three-quarters of its substance may have been eaten by the larva—the little white, fat-bodied grub which we all know so well. As soon as the larva is full-fed, it nibbles a round hole through the shell of the nut, escapes through it and falls to the ground, into which it wriggles its way, and then undergoes its transformations.

As the grub is concealed within the nut until all the mischief is done, there is scarcely any possibility of checking the

evil. It has been suggested that, as the nuts which have been attacked by this Beetle become rather loose on their stems, the branches should be beaten before the nuts are ripe, and all the fruit that falls should be burned. Eight species of this genus are known. The larva of the Nut Weevil is shown on Woodcut XVIII. Fig. *b*, and the pupa at *f*. The name *Balaninus* is



1. *Tychius venustus*. 2. *Orchestes fagi*. 3. *Orobites cyaneus*. 4. *Cœliodes quercus*.
 5. *Sitophilus oryzae*. a. *Cœliodes*, head. b. *Orchestes*, head. c. *Orchestes*, hind leg.
 d. *Orchestes*, antenna.

derived from a Greek word, signifying an acorn, because the acorn as well as the nut is attacked by species of the same genus.

THE genus *Tychius* has also a long beak, but the body is rounded and oval instead of triangular, and the thorax is nearly globular. An example of this genus, *Tychius venustus*, is given on Woodcut XIX. Fig. 1. These are all pretty insects,

their bodies being thickly clothed with variously coloured scales. The present species is one of the prettiest of them, although its colours are not brilliant. The upper part of the body is covered with ashen-grey scales, the elytra being striated and punctated, with very narrow and delicate white longitudinal streaks. Beneath, it is pure white. This seems to be rather a local insect, but is found plentifully in certain spots, of which Darenth Wood is one. It frequents plants of the vetch tribe, and has been taken on the broom.

WE now come to a strange genus of Weevils, strange in their forms, and strange in their ways. They are all very tiny Beetles, rarely more than the tenth of an inch in length, and generally much less. The femora of the hind legs are exceedingly thick and strong, and the Beetle uses them for leaping, an exercise which it pursues with wonderful agility.

From this peculiarity, the genus is named *Orchestes*, a word which signifies 'leaper.' One of these Beetles, *Orchestes fagi*, a name which may be translated as 'beech-hopper,' is represented on Woodcut XIX. Fig. 2, its head is shown at Fig. *b*, and its hind leg at Fig. *c*.

Small as are these Beetles, they are able to do a vast amount of harm, not so much in their perfect as in their larval state. The larvæ of this genus are long and flat, as is necessary for their mode of life. They burrow into the leaves of various trees, penetrating between the upper and under layer of the leaf, and feeding on the 'parenchyma,' a soft green substance that lies between them. Mr. Curtis mentions some observations which he made on the habits of the insect which we have taken as our example:—

'In 1832, Lord Farnham informed me that the beech-trees on his estate in Cavan, Ireland, had for the last three or four years suffered, not only in appearance, from the leaves being partially blighted by a species of these insects, *Orchestes fagi*, in June and the beginning of July, when they assumed an autumnal appearance, but the general health of the trees seemed to be considerably impaired. It appeared that, on the bud opening, it was immediately occupied by the *Orchestes*, which perforated the leaves, and to so great an extent that scarcely a tree escaped.

‘On June 10, in the previous year, in a ramble through the New Forest, I observed that the leaves of the trees looked very brown, and those of the beech were quite blistered. This I at first attributed to the severe frost we had in the morning of May 6, but on examining them I found a larva inclosed in each leaf, which in a short time changed to *Orchestes fagi*; so that at the period when Lord Farnham observed it in Ireland, this Beetle seems to have been equally abundant in England.’

Twelve species of this genus are known in England, and most of them are named after the trees which they inhabit. Many more species are described by the older entomologists, but it has now been ascertained that many supposed species are nothing but varieties, our present example having been described under five names. The colour of this species is black, with the exception of a reddish down scattered rather sparingly over the elytra. It is, however, a variable insect, sometimes having the downy clothing green instead of red.

WE now come to a family of Weevils called Cryptorhynchidæ. This name is composed of two Greek words, signifying ‘hidden snout,’ and is given to this group of Beetles because they have the beak bent downwards, and capable of being received into a groove on the under side of the body. This attitude is assumed when the Beetle is in repose or alarmed. On Woodcut XIX. Fig. 4, is represented one of these insects, named *Cœliodes quercus*, the head of which is shown at Fig. a. In this genus the hollow in which the beak lies is between the first and middle pairs of legs, and it is on account of this channel that the name *Cœliodes*, or ‘hollowed,’ has been given to the genus.

These are all very little, dumpy-bodied, sober-coloured insects, and, when placed under the microscope, they bear a curious resemblance to the apteryx, whose round body and long curved beak almost exactly reproduce the form of the Weevil. They are generally to be found on nettles, and can be taken with the sweep-net. Owing to the rotundity of their bodies, they are very difficult subjects for the setting board. Moreover, in death, the head always bends itself downwards, and the beak tucks itself so firmly into its groove, that to bring it out without injuring the insect is no easy matter.

Although this species is not a brilliantly-coloured one, it is

very pretty when viewed through a lens. The colour is pitchy-black, the head and thorax being thickly granulated. The elytra are striated and punctated, and are variegated by a few whitish patches. The under surface of the body is clothed with white down. As its specific name implies, it is to be found upon the oak.

OUR next example of this family is *Orobites cyaneus*. The genus is known by its globular and polished body, and the short groove on the chest. The insect which is figured is the only British species of its genus, and is by no means common. Vetches are good localities for it, and it has been found on willows and in hedgerows. Its colour is very dark-blue, and it has a curious way of avoiding observation if alarmed. As the reader may see by reference to the illustration, its legs are rather long in proportion to its body; yet, it possesses the power of packing them so tightly under its body, that it looks more like a dry polished seed than an insect, and, in order to assist the deception, it is instinctively taught to remain perfectly still as long as any sign of danger remains. The generic name *Orobites* is Greek, and signifies 'vetch-eating,' and the specific name *cyaneus* signifies 'dark-blue,' so that both titles are perfectly appropriate.

OMITTING of necessity several genera of these insects, we come to one which is among the most destructive of the group. This is the RICE WEEVIL (*Sitophilus oryzae*), which is shown on Woodcut XIX. Fig. 5. The generic name of *Sitophilus* signifies 'grain-lover,' and is given to the insect on account of the terrible havoc which it makes in corn-stores. It belongs to the family Calandridæ, of which there is only one British genus, that which has just been mentioned. In this family the antennæ have eight joints, the last joint being large and rounded. The body is rather flat, and the elytra, which are boldly striated, do not quite cover the end of the abdomen. There is another species, the CORN WEEVIL (*Sitophilus granarius*), which feeds upon corn as the present species does on rice. The Rice Weevil is distinguished by having four red spots on the elytra, the Corn Weevil being altogether dusky-red.

Like the Nut Weevil, these insects do their destructive work in secret, and there is no finding out the mischief until it is too late. The mother Weevil—tiny herself—inhabits a tiny hole in a grain of corn, and therein deposits a single egg. The larva is soon hatched from the egg, and sets to work at feeding in the interior of the grain, the whole of which it consumes, leaving the exterior untouched, so that the grain appears quite sound. Of course, the damaged grain is lighter than the sound one, the body of the larva not compensating in weight for the amount of substance devoured by it; and, if the corn be thrown into water, the damaged corn will rise to the surface, and may be skimmed off and burned. As, however, damaged corn and rice can both command a sale, and as all damaged grain is not attacked by the Weevil, the dealers will seldom employ such a measure; though to destroy all the light corn for the sake of killing the Weevils would in the long run be more profitable than keeping it for sale and allowing the Weevils to live.

The destruction wrought by these tiny foes can scarcely be over-estimated, but some idea of it may be estimated from the following statements which were made at the Entomological Society, April 4, 1870. Seventy-four tons of Spanish wheat had been carefully sifted or 'screened' to separate the Weevils from it, and out of this quantity *ten hundredweight of Weevils* were sifted. Again, one hundred and forty-five tons of American maize were subjected to the same process, and at two siftings *a ton and three-quarters* of Weevils were removed. Now, each of these Beetles had consumed several times its own weight of corn before it attained the perfect state; and the reader may see that, if the grain had been subjected to the water-test and the light portion burned, the proprietor would have saved the cost of some two tons of corn, instead of all owing it to be eaten by these insect devourers, the stock of whom increased in proportion to the diminution of the stores. It is rather a remarkable fact that all these Beetles were Rice, and not Corn Weevils, although there was no rice among the grain which they so seriously damaged.

The larva of these Beetles is very short, fat, and thick, and has two recurved hooks at the end of the body. It remains inside the grain throughout its larval and pupal life.

THERE has been some controversy among systematic entomologists with regard to the insects which come next in order. Some, thinking that they ought to form a separate group, have given them the name of *Xylophagi*, i.e. 'timber-eaters;' while others have contended that they are really Weevils, and ought to form the last family of that group. The weight of opinion seems to be on the latter side, and we will therefore take some examples of the family of Weevils, called *Hylesinidæ*, i.e. 'wood-devourers.' The name is a very appropriate one, as we shall presently see.

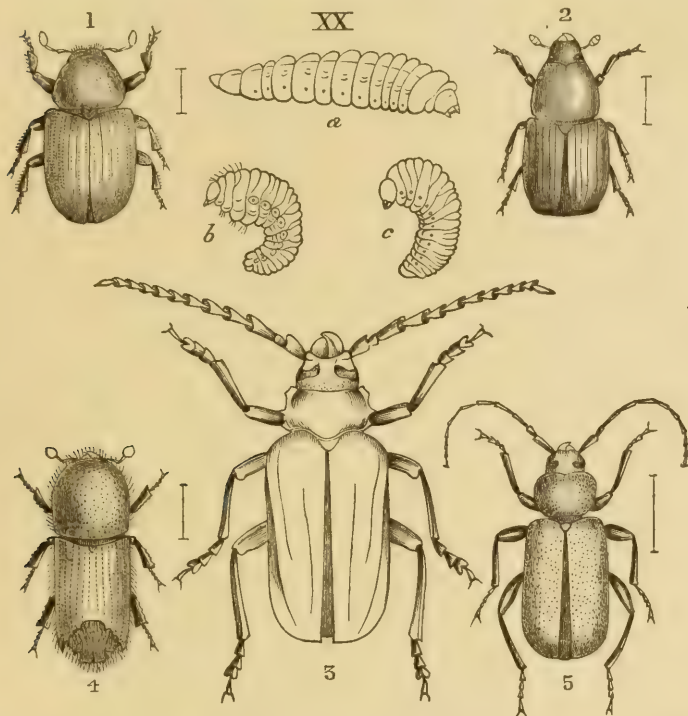
In this family of Weevils the head has but a very short beak, and is globular in shape and deeply sunk in the thorax. The antennæ are elbowed, and have a long basal joint and a flattened club. The front tibiæ are broad at the tip, and used for digging purposes, and the mandibles are short, strong, sharp, and triangular. They are all timber-feeders, and sometimes work terrible destruction in the forests, even when the trees are still living.

Our first example of this insect is called *Hylesinus crenatus*, and is represented on Woodcut XX. Fig. 1. This genus may be known by the long oval club of the antennæ, and the slight spurs of the tibiæ. The colour of this insect is black, the thorax is thickly and boldly punctured. The elytra are pitchy-black, and are both striated and 'crenated,' i.e. covered with marks like parts of circles. From this peculiarity, the insect has derived its specific title, *crenatus*. The interstices between the striæ are wrinkled. The body is covered with down, and rather elongated. This is not a very common insect, but may be found under the bark of old trees. Four species of this genus inhabit England.

ON Woodcut XX. Fig. 2, is shown the most destructive wood-eating Beetle that we have in this country. Its name is *Scolytus destructor*, and a very appropriate name it is, the generic name being of Greek origin, and referring to the winding passages or burrows which it makes when in the larval state, and the specific name explaining itself. There are six species of British Scolyti, but the present example serves as the best type of the whole genus. This genus is distinguished

by the shape of its body, which is obliquely cut off behind, and by the club of the antennæ, which is three-jointed, solid, and flattened. The last joint but one of the tarsus is cleft.

The colour of our species is slightly variable, but is mostly as follows:—The head is black, wrinkled longitudinally, and the thorax is very large in proportion to the size of the insect,



1. *Hylesinus crenatus*. 2. *Scolytus destructor*. 3. *Prionus coriarius*. 4. *Tomicus typographicus*. 5. *Callidium violaceum*. a. *Prionus*, larva. b. *Tomicus*, larva. c. *Scolytus*, larva.

and is covered with very small punctures. The elytra are sometimes black, sometimes pitchy, and sometimes bright-chestnut, and are striated, the spaces between the striæ being punctured. So much for the appearance of this Beetle—we will now proceed to its history.

When the mother *Scolytus* is about to deposit her eggs, she flies to a tree, and searches about the bark for a favourable spot. Having found it, she sets to work and gnaws a hole

completely through the bark, until she gets between the bark and the solid wood. She next drives a tunnel, scarcely wider than her own body, and then goes back along the tunnel, and deposits her eggs along it. In many cases she exhausts all her life-powers in the effort, and dies before she can entirely escape from the burrow, the entrance of which is stopped up by her body, so that no foe can enter.

The eggs are soon hatched, and then the larvæ begin their destructive work. They feed on the soft inner bark, and each larva, as it feeds, instinctively turns itself at right angles to the burrow in which it was hatched, and gnaws for itself a tunnel, which widens in proportion to the growth of the larva. These burrows extend for an inch and a half or two inches in length, and the result is, that a piece of bark, some three inches or more in diameter, is completely severed from the tree and can no longer perform its office. At the widened end of the burrow the larvæ assume the pupal form, and, after undergoing their change into the perfect insect, gnaw their way through the bark, and are ready to lay the foundations of new colonies.

When a great number of these insects bore into a tree, they often destroy it entirely, the bark being separated as completely from the wood as turf is severed from the ground when the spade is passed under it. There is a tree—or rather, what was a tree—standing within a few yards of my house, which has been killed by the *Scolytus*. The whole of the bark has peeled off, and nothing is left but the naked wood, scored all over with the radiating tunnels of the destroying insect.

Should the reader wish to examine this insect for himself, he will find no difficulty in so doing. He has only to visit any place where elm-trees grow, and he is nearly sure to find the *Scolytus* under the bark. August is perhaps the best time for the purpose, as then the perfect insects, the larvæ, and the pupæ can be discovered. The larva is white, thick, and fleshy, the back is deeply wrinkled—probably to aid the creature in forcing its way through the wood, this being an absolute condition of existence. It cannot remain in the same place, because it grows so fast that the unyielding substances around would not permit its increase in size, and it would in consequence soon perish. It is forced, therefore, to push itself onwards, and to occupy the space which was originally filled

by the wood and bark on which it has fed, and for this purpose the bold wrinklings of the upper surface afford as useful means of progression to the insect as the ventral scales of the snake do to the reptile. The head is hard and scaly, and the jaws are exceedingly powerful. One of these larvæ is shown on Woodcut XX. Fig. c.

When nearly full-fed, the greater number of the larvæ burrow directly into the tree, making holes about half an inch in depth, at the bottom of which they are quite safe, even though the bark should fall off, as is often the case. They are, further, protected from weather and the eyes of hungry birds by the 'frass,' or digested remains of the wood, which fills up the tunnel behind the larva. It is much doubted whether the Scolytus ever attacks a healthy tree, principally, as is conjectured, because in such trees the burrows of the insects are filled with sap, which not only drives out the Beetles, but prevents their eggs from being hatched. Still, when a tree becomes unhealthy, the attacks of the Scolytus prevent it from recovering itself; and such serious damage has been done by this insect to our trees, especially the elms in and about London, that the attention of entomologists has long been directed to the subject, in hopes of discovering some device by which the ravages of the Scolytus may be checked, if not altogether stopped. As yet, however, no scheme has succeeded. Various plans have been suggested, such as injecting poisonous fluids into the hole made by the mother Scolytus. This might possibly answer, provided the operator could be sure of discovering all the holes, and provided that the liquid did not kill the tree as well as the insect. The 'Gishurst Compound' would do as much in this way as anything could, but it cannot be employed on a large scale.

At present, the opinion seems to be that the only plan which offers the least probability of success is a 'stamping out' process, similar to that which saved us in the time of the cattle-plague. By this plan, all trees which are visibly attacked by the Scolytus are to be cut down, and stripped of their bark and the outer layer of wood, which are then to be burned, so as to destroy the Scolytus, its larvæ, pupæ, and eggs.

Dr. Chapman states that all the species of Scolytus are in the habit of fighting with each other. They 'have a fashion of

placing their foreheads against other individuals, and giving a thrust by pushing forward the jaws. They employ this process to remove another Beetle from a station which they desire to occupy; it appears also to be an expression of anger, sometimes two Beetles having an encounter in this way; and they use the same movement in recommending themselves to the other sex.'

OUR last example of the Weevils is a tiny Beetle, which, though quite as destructive as the *Scolytus*, is, happily for us, not nearly so plentiful. It is called *Tomicus typographicus*, and a figure of it is given on Woodcut XX. Fig. 4. This genus is distinguished by the club of the antennæ, which is four-jointed and rounded. The present species is blackish, clothed with rather long yellow hair. The thorax is very long, and there is a space between it and the elytra, which are deeply striated and punctated; the spaces between the striæ being convex and smooth. The apex of the elytra is abrupt and rather turned up, and has six distinct teeth, the fourth being the largest.

This insect attacks the fir, and in some parts of Europe does even worse harm to those trees than the *Scolytus* does to the elm in this country. The larva makes tunnels under the bark, but, instead of proceeding in a tolerably straight line, as does the larva of *Scolytus*, it makes a devious track, which often presents a fanciful resemblance to letters; hence its name of *typographicus*, or 'letter-writer.'

In the pine-producing districts of Germany there is great dread of this Beetle, which is popularly called the Turk, the tracks left by its larva being known by the name of Wurm-trockniss. So terrible are sometimes the ravages of this Beetle, that towards the end of the last century more than a million and a half of trees were destroyed by the *Tomicus* in the Hartz forest alone, without reckoning those that perished in other parts of the country. Thirteen species of this genus are known to inhabit England, and some of them are plentiful.

CHAPTER XII.

LONGICORNES.

THIS group of Beetles derives its name from the shape of the antennæ, which are generally long, though in some of our commonest species they are only of moderate length; but, whether they be long or short, they are never clubbed, and are mostly slender and thread-like. Their head is not lengthened into a beak like that of the preceding group, and the elytra are always broader at the base than the thorax. There are other peculiarities of structure, but these are quite sufficient to distinguish them. Indeed, there is something so characteristic in the appearance of a Longicorn Beetle, that even a novice finds no difficulty in recognising it.

They are all wood-borers in the larval condition, and are thin, long, whitish grubs, rather flattened, and with the segments boldly marked. By means of this latter structure, the larvæ are able to force their way through the wooden tunnels in which they live. They possess the usual six legs, but these limbs are only rudimentary, and of no use in locomotion. One of these larvæ is shown on Woodcut XX. Fig. *a*. As the grub has to feed upon hard material, it is furnished with very strong horny jaws, and, in order to accommodate the muscles which move these jaws, the head is very broad and covered with a hard skin, nearly as strong indeed as the jaws themselves. In consequence of their habits, the proceedings of the larvæ are difficult of observation, and require machinery such as few entomologists can hope to possess. Still, by carefully opening the trees which are infested by these destructive insects, much can be learned of their habits, and many pleasant and instructive hours can be spent in this task. We will now proceed to examine some of the British species of the Longicorn Beetles.

OUR first example is the largest, though by no means the

handsomest, of our Long-horned Beetles. It is called *Prionus coriarius*, and is represented of the natural size on Woodcut XX. Fig. 3. It is the only British representation of its family, the Prionidæ, though there are many exotic species belonging to it. In this family the labrum is so small that it is scarcely visible, while the mandibles are large and strong. The antennæ are moderately serrated, and inserted just above the base of the mandibles, and the head is not narrowed behind into a neck. The thorax is rather squared and furnished with spines at the sides, and the elytra are lengthened, with blunt spines at the tips.

The colour of this Beetle is blackish-brown above and chestnut-brown below, the colour being, however, rather variable in different individuals. Like the Stag Beetle it is exceedingly variable in size, some specimens being twice as large as others, the difference in size being probably owing to the quality and quantity of the food. The larva is white, flattish, broad at the part which will afterwards become the thorax, but narrowing towards the tail. The rings, or segments, are deeply marked, and the legs are very small, the grub being able to force itself through its burrow by the alternate extension and contraction of its body. In this task it is aided by certain fleshy projections attached to the segments which constitute the abdomen. One of these larvæ is shown on Woodcut XX. Fig. a.

When it is nearly full-fed, it makes its way towards the bark of the tree on which it feeds, and then forms from the wood-chips a cocoon, in which it awaits its change into the pupal form. In this stage of development, the long and boldly notched antennæ are laid along the sides of the body, over the elytra.

This is not a common Beetle, being necessarily restricted to wooded districts. It is, however, much more plentiful than is generally supposed, owing to its peculiar habits, which withdraw it from the notice of all but skilful entomologists, who not only know where to look for it, but how to recognise it when they see it. For the *Prionus* is a lazy, sluggish sort of insect, which seldom betrays itself to the unpractised eye. It is essentially a being of darkness, and, contrary to the habits of many Beetles, carries into its adult life the darkling ways of its early stages of existence. During the day it remains



PLATE VI.

GLOW-WORM, OIL-BEETLES, WEEVILS, LONG-HORNS,
AND LADY-BIRDS.

1. *Lampyris noctiluca* (Male).
2. *Lampyris noctiluca* (Female).
3. *Meloë cicatricosus* (Male).
4. *Meloë cicatricosus* (Female).
5. *Meloë cicatricosus*, larva (full grown).
6. *Phytonomus tigrinus*.
7. *Lixus bicolor*.
8. *Lixus bicolor*, nest.
9. *Aromia moschata*.
10. *Clytus arietis*.
11. *Cassida murina*.
12. *Coccinella septempunctata*.

PLANTS:—

Willow (*Salix alba*). Above.

Wild Carrot (*Daucus carota*). Left of Middle.



perfectly still, clinging to the trunk of some tree, and harmonising so well with the colour of the surface that it may easily be mistaken for a mere excrescence of the bark. By night, however, it flies in search of its mate, and is sometimes seen by entomologists who are engaged in the pleasing task of 'sugaring' for moths at night in some wood. Darenth Wood is one of the favoured localities of this insect, two specimens of which were lately captured there by R. Evans, Esq., as they were clinging to the bark in fancied security.

The name *Prionus* is taken from a Greek word, which signifies a sawyer, and is given to the insect on account of its wood-destroying habits.

NEXT in order comes the family of the Cerambycidæ. This name is a Greek one, and is apparently given to the group of Beetles on account of their long antennæ, or horns, the Greek word *keras* (unfortunately written *ceras*) signifying a horn. In this family, the head is slightly bent downwards, the thorax is widened at the sides, and the antennæ, which are never serrated, are inserted in the inner margin of the eyes, which are semilunar.

Our first example is the beautiful MUSK BEETLE (*Aromia* [or *Cerambyx*] *moschata*), an insect which is equally grateful to the eye and the nostril. One of these Beetles is shown on Plate VI. Fig. 9. This is really a lovely insect, the shape being peculiarly elegant, and the colour a soft green, sometimes glossed with blue, gold, copper, or bronze, the hue being exceedingly variable. Even the thorax partakes of this variability, being sometimes rough, and sometimes very smooth and glossy.

It owes its popular name to the powerful and pleasing odour which it exhales, and which is said by some persons to resemble ottar of roses. For my part, I never could perceive much resemblance between the somewhat sickly scent of the ottar and the fresh sweetbriar-like odour of the Beetle. This scent can be perceived at a considerable distance, and the presence of the Beetle can often be detected by it, even when the insect is itself concealed. Shortly after I came to live in West Kent, I was passing along the road, and declared that a Musk Beetle was in the neighbourhood. My companions, not knowing the

scent, could not believe me, and made themselves rather merry on the subject. In the course of the day, however, one of the same party, a young lady, was passing by the same place, and carried off a fine Musk Beetle in her hair.

The scent of this insect is said to be more powerful in the breeding season than at any other time of the year, and stronger in the female than in the male. This is very likely to be the case, and will serve to explain the mysterious manner in which many night-flying insects contrive to find their mates in the hours of darkness. In the present instance, the odour happens to be one of which our senses are cognisant; but it may well be that other insects, though to our nostrils absolutely scentless, may yet emit an odour which is as evident to them as is that of the Musk Beetle to us. The scent of this insect is as enduring as it is powerful, and, if the Beetle be held with a gloved hand, or wrapped in a handkerchief, it will impart either to the kid or cambric its peculiar odour, which will last for a very long time. From a series of experiments made some few years ago, I have come to the conclusion that the Musk Beetle can emit or retain its odour at pleasure as long as it is in full health, but that when the insect is weak, or in a dying state, it is unable to retain the scent.

The Musk Beetle is one of the Beetles which are popularly called Squeakers, on account of the sound which they are capable of producing, and which somewhat resembles the squeak of a bat. If the reader will watch one of these insects while producing the sound in question, he will find that it moves its head smartly up and down, so as to cause the sound by the friction of one part of the hard surface against another. If the Beetle be held in the hand, the whole body is perceived to quiver with the exertion.

Wherever willow-trees are to be found abundantly, there the Musk Beetle is sure to be, because it feeds on the interior of that tree while in the larval state. The ground on which my house stands being very high, and the soil being gravel, I was very much surprised at perceiving the Musk Beetle which has just been mentioned, thinking that no willow-trees were near. However, after a while, I came upon some of these trees, at a distance of some 300 yards, growing on the banks of a little stream that ran in the valley below. Sometimes a tree is

absolutely riddled with the burrows of these larvæ, which bore deeply into the very heart of the timber, and leave little except a shell of bark surrounding a sort of soft wooden sponge.

If one of these trees be opened, the scene disclosed is a very remarkable one. In the first place, the scent of the Beetles is overpowering, and in the next, the wood is filled with a wonderful variety of animal life. In some burrows, close to the bark, may be seen the glittering green bodies of newly-developed Beetles, as they lie waiting until their surfaces have acquired sufficient hardness to enable them to face the dangers of the world; in others the helpless pupæ may be seen; and in others, the white, flat, soft-bodied, hard-headed larvæ move themselves restlessly as they perceive the unwonted light. The many burrows which have been evacuated by their makers are, however, seldom empty, but have plenty of tenants in the shape of woodlice, centipedes, earwigs, spiders, millipedes, and sundry predacious Beetles, the latter having evidently entered the burrows in search of food.

Those who wish to capture the Musk Beetle will find that they cannot do better than explore the largest, the oldest, and the most rugged willow-trees. The Musk Beetle is not a very active insect, and is fond of clinging to the bark of the willow, and remaining perfectly still for many hours together. I may mention that the surface of this Beetle affords a most gorgeous object for the microscope.

ON Woodcut XX. Fig. 5, is drawn a very pretty Beetle called *Callidium violaceum*. In this genus the head is sunk in the thorax nearly as far as the eyes, which are semilunar. The body is slender, and the legs short.

The present species derives its specific name from its colour, which is violet, sometimes glossed with green or bronze. Whatever may be the exact hue, a deep, rich, shining violet is always the predominant colour—a violet that would make the fortune of any dyer if he could only transfer it to silk. The elytra are thickly and coarsely punctured. This pretty little Beetle is thought to have been introduced into this country from America. It is well known that wood-boring Beetles are often transported from one country to another, the larva or pupa remaining in the wood after the tree is cut down

and shaped into timber. Sometimes a Beetle has been known to emerge from a piece of furniture which has been in the house for several years, the changed conditions having retarded the growth of the Beetle. This insect inhabits the fir-tree, and, as it has of late years become comparatively plentiful from being one of our rarest Beetles, it is likely that many specimens are imported in the fir cargoes from Canada, where it is one of the commonest of insects.

The owners of the trees in question would be only too glad if the Beetle were less common, for it does very great damage to the timber, seizing upon the trees soon after they are felled, and laying its eggs in crevices of the bark. When the larvæ are hatched they set to work at their burrows, driving oblique tunnels deeply into the body of the tree, and so spoiling the timber. As is necessary for such a task, the larva is furnished with exceedingly stout and strong mandibles. Four British species of *Callidium* are known.

ON Plate VI. Fig. 10, may be seen a figure of a very common and very pretty Beetle, belonging to the same family, and known to entomologists by the name of *Clytus arietis*. In this genus the antennæ are shorter than the body, the last joint being somewhat conical. The palpi are short, with the last joint stout and three-sided, the angles being rounded. The thorax is globular, and the body is cylindrical.

The colour of this species is black, with three yellow bands across the elytra, and a yellow patch at their tips, so that the insect has a very waspish look, and is popularly known as the WASP BEETLE. The similitude is increased by its fussy mode of walking, and the perpetual movement of its antennæ, and, as it crawls in and out of the foliage on hedges, it has so very wasp-like a look that few persons, except they be entomologists, like to touch it. In its larval state it burrows into wood, and emerges somewhere about midsummer. It is fond of frequenting flowers, and can be taken in almost any quantity. Being rather variable in the hue of its markings as well as in size, a series ought to be taken for the cabinet.

Like many wood-boring insects, it sometimes makes its appearance when it is least expected. In 1833, for example, Mr. Denny described a curious visitation of the Wasp Beetle in his

museum. He had a case of stuffed birds, in which the birds had been made to perch on oak branches. These branches had been first carefully dried and then baked, and yet, after the lapse of three years, three specimens of the Wasp Beetle emerged from the branches, having survived the very unpleasant process to which they had been subjected.

This is not a solitary instance of the appearance of the Wasp Beetle. In 1865 a piece of pollard oak was sent to the British Museum, for the purpose of exhibiting the round, hard galls of *Cynips lignicola*, which was then not nearly so common as it is now. The oak, with its crop of galls, was placed in a glass case, together with a large lump of camphor, a material which is supposed to be poisonous to insects. Yet, on every succeeding spring, several specimens of the Wasp Beetle made their escape from the wood in which they had passed their larval state, the camphor having had no injurious effect upon them. A still more curious example of the unexpected appearance of a wood-boring Beetle will presently be mentioned.

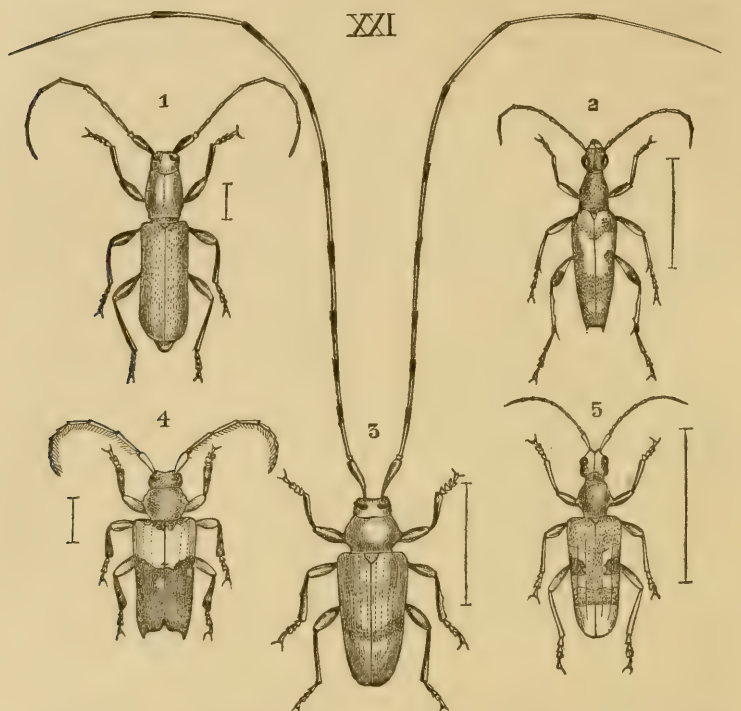
OUR last example of this family is shown on Woodcut XXI. Fig. 1. Its name is *Gracilia pygmaea*. This genus is to be distinguished by the long slender body, the clubbed femora, the long fifth joint of the antennæ, and the elongated last joint of the palpi.

As its specific name implies, this is a very small insect, never exceeding a quarter of an inch in length, and being generally much less. The colour of the Beetle is reddish-brown, with the exception of the under surface of the abdomen, which is shining-black. There is an angular projection in the middle of the elytra.

This tiny wood-borer is one of those insects which are very local, but very plentiful in those places which they choose for their residence. Sometimes it prefers to live in houses, and sometimes in the open air. It takes as great a range in point of diet as in residence. Its ordinary, and indeed its normal, food is decaying wood, and the insect may accordingly be found in old railings and similar localities. But it sometimes takes a strange fancy for leather, and has been captured in some numbers while feeding on old shoes. Sometimes specimens of this insect have been taken in the middle of flour-

barrels; the larvæ having probably been hatched in the wood of which the staves were made, and then relinquished their original habitations for the richer diet furnished by the flour.

WE now come to a most extraordinary insect, which is drawn on Woodcut XXI. Fig. 3. It goes by a great number of names. The scientific title by which it is now known is



1. *Gracilia pygmaea*. 2. *Strangalia armata*. 3. *Astinomus ædilis*. 4. *Pogonocerus pilosus*. 5. *Rhagium inquisitor*.

Astinomus ædilis. There is no possibility of mistaking this insect, our sole representative of its genus, which may be known by the broad flattened body, the tubercles on the sides of the thorax, and the enormous length of the antennæ, which in the females are twice as long as the body, and in the males sometimes more than four times the length of the body. This inordinate length is obtained by the elongation of the joints, not by multiplying them.

This is essentially a northern insect, being seldom seen alive south of Scotland. Rannoch Wood is the best known locality for this wonderful Beetle, and in that favoured spot the experienced entomologist will generally manage to capture it. Indeed, it is plentiful enough to have gained a popular name, that of TIMBERMAN, not only because it frequents timber, but because its long antennæ present, when spread, a curious resemblance to a pair of compasses, these being used by the timbermen in calculating the cubic contents of a tree-trunk or log of wood. The specific name, *ædilis*, is that of the officer who in ancient times had charge of houses and public buildings. When the insect flies, the long antennæ trail behind it, and present a very curious appearance.

Unfortunately for the entomologist, the males are exceedingly quarrelsome, and when two of them meet together they are sure to fight, especially if one of the opposite sex be at hand. Their combats are so fierce that mutilation is sure to be the result to one or both, so that a perfectly complete specimen is of no small value for the cabinet.

In its larval state the Timberman Beetle lives in the interior of pine stumps, its tunnels being of considerable size. When it is full-fed, it makes a nest near the bark, in which it changes to the pupal state. The pupa of a male Timberman presents a very curious sight. All insects with long antennæ have some remarkable mode of packing them away while they still retain the pupal form. In this Beetle they are brought down by the sides, along the body, and then curled back again over the head, so as to make two large loops, one on each side. The larva changes to the pupal form somewhere about the end of May, changes again to the perfect form in about a month, but does not leave its nest until the following summer, its surface gradually gaining consistence and hardness during the time of its long repose.

It has been already mentioned that this is a northern insect. Only the day before writing this account I was in the British Museum, and asked whether the Timberman had ever been taken in any of the southern parts of England. The answer was, that the only southern place where it had been captured alive was the British Museum. The insect had been discovered within the walls of the Museum, having evidently escaped

from timber which was being used for building purposes. This Beetle has also been discovered embedded in a seam of coal at Coatbridge, at a depth of nearly 900 feet from the level of the ground. It is evident that the insect must have emerged from some of the timber which is so largely employed in coal-mines.

A RATHER remarkable Beetle is shown on Woodcut XXI. Fig. 4. Its name is *Pogonocerus pilosus*, both of which titles refer to the structure of the antennæ. In this genus the body is short and rather convex, the disc of the thorax is covered with tubercles, the tips of the elytra are developed into spines, and the antennæ are covered beneath with a clothing of hair. The generic title *Pogonocerus* (mostly, but wrongly, spelt *Pogonocherus*) is formed from two Greek words, the one signifying a beard and the other a horn; so that the whole word may be translated as 'bearded-horn.' The specific name, *pilosus*, is Latin, and signifies 'hairy.' There are three known English species, one, *Pogonocerus fascicularis*, being very rare, and the other two moderately plentiful. The present species has the tubercles of the thorax pointed, and there are two sharp spines on either side of the thorax. The general hue of the insect is reddish-brown, the elytra having a broad grey band at the base, and some black spots near the suture. They have also a single spine on the outer edge.

The second species, *Pogonocerus hispidus*, may be distinguished by the fact that it has two tubercles on the upper surface of the thorax, one spine on each side, and the tip of each elytron developed into two teeth, of which the outer is the longer. There are also some little black patches of hair near the tips, close by the suture. All these species have much the same habits, and can be found among dry wood.

THE insect which is represented on Woodcut XXI. Fig. 5, is called *Rhagium inquisitor*, and belongs to the family of the Lepturidæ. In this family the eyes are nearly rounded, and the antennæ are of moderate length and set before the eyes. The head is bent rather downwards and narrowed into a neck, the thorax is narrower in front than the head, and the elytra are gradually narrowed from the base to the tips. In the genus

Rhagium the body is rather flattened, and there is a sharp spine at either side of the thorax. The word *Rhagium* is a Greek one, and signifies a little berry.

There is not the least difficulty in distinguishing the present species. The colour is blackish, but the surface is covered with a very fine yellowish down, and is thickly punctated. The elytra have an elevated line, or rib, running longitudinally along them; and upon the middle, or disc, there are two irregular reddish-yellow bands, placed as shown in the illustration. During its larval existence this insect lives in decaying ash and willow-trees, and may be dug out of them in spring, and found on and about them in summer.

There is another species, not so common as the former, which inhabits decaying fir-trees. Only a short time before writing this account, I dug several of them out of some fir-stumps near my house. In one small stump, not more than seven inches in diameter, I found four specimens. The name of this species is *Rhagium bifasciatum*. It is marked much as is the preceding insect, but may be known by a conspicuous groove along the top of the head, and the fact that the elytra have three longitudinal ridges instead of one. The yellow bands, too, are shorter, and the colour both of these and the elytra is exceedingly variable.

It is a remarkable fact that these insects invariably assume a perpendicular position before changing into the pupal form. They may always be found with their heads upwards, and their antennæ and legs packed closely against their bodies. Their behaviour when the light is allowed to shine on them is rather variable, and depends much on the weather. Should the day be a warm one, the *Rhagium* seems glad to escape, and struggles hard to free itself from the decaying wood with which it is surrounded; but on a cold day, especially if there be a sharp wind, the insect retreats as far as possible into its curious nest, and tries to shelter itself alike from wind and light.

The nest, or cocoon, which the Beetle makes is a very curious one. Just before it undergoes its change into the pupal form, it prepares an oval chamber, and within this chamber makes a cocoon from rather long wood-chips, which it arranges with great art, so as to form a soft bed in which it can repose during the long period of quiescence. It is not easy to procure

one of these nests, owing to the fragility of the material. One of them, in which a female *Rhagium* was reposing, was found in the fir-wood which has just been mentioned. The excavation is rather more than an inch and a quarter in depth, and the actual cocoon, which lies at the bottom of the burrow, is five-eighths of an inch long and not quite a quarter of an inch wide. The mouth of the excavation, however, is an inch and a quarter in length, and a little more than a quarter of an inch in width. I noticed that the inhabitant of this burrow, instead of availing herself of the opportunity of escape, as did all the others, crept closely into the recesses of the cocoon as soon as it was opened, and would not leave it until she was removed by force. The same stump contained two other nests of the *Rhagium*, but none so perfect as that which has been described.

ANOTHER Beetle, belonging to the same family, is shown on Woodcut XXI. Fig. 2, and is known by the name of *Strangalia armata*. In this genus the thorax is without spines, is narrow in front and flattened above. The body is very narrow and almost pointed behind. The front of the head is rather lengthened. The present species has the ends of the elytra deeply cut, so as to form a rounded notch with toothed edges, and the male can be recognised by two conspicuous tooth-like processes on the inner side of the hinder tibiæ. Owing to these peculiarities, the specific name of *armata*, or 'armed,' has been given to the Beetle. In colour and size it is one of the most variable of British Beetles, scarcely any two specimens being exactly alike. Sometimes it is almost entirely black barred with yellow, sometimes yellow barred with black, while it varies in length from five lines to three-quarters of an inch. Being so variable, the entomologist ought to have a series of specimens in his cabinet. There is not the least difficulty in obtaining them, as it is a very common Beetle, and can be found in plenty upon the umbelliferous plants—these being the favourite resorts of many Beetles. It is tolerably active, and takes to the wing as soon as it is alarmed. Seven species of this genus are known in England.

CHAPTER XIII.

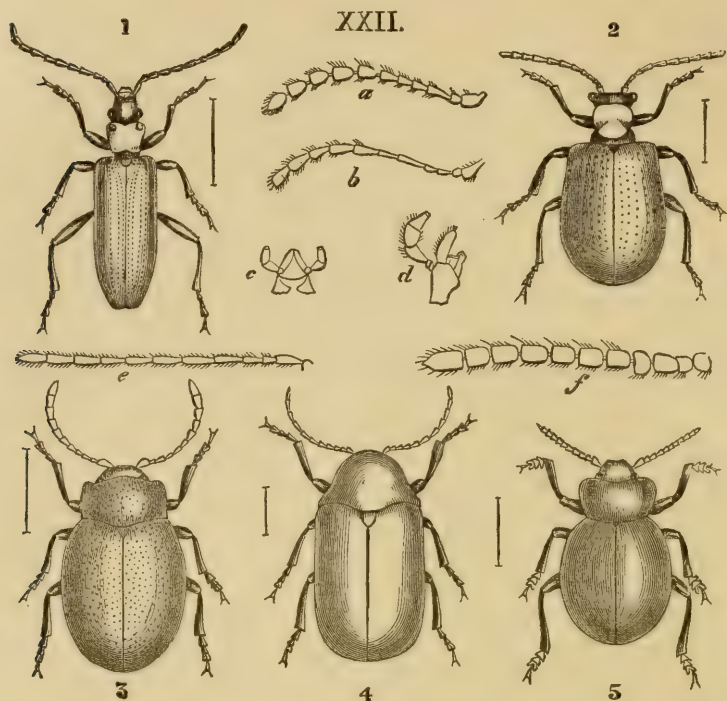
EUPODA.

WE now leave the Longicorn Beetles, and come to another section, called the EUPODA, a name derived from two Greek words, signifying 'beautiful feet.' By some authors the section is named *Phytophaga*, this word being also of Greek origin, and signifying 'plant-eater.' They are all pretty insects, and some of them, though not large, are singularly beautiful both in form and colour. In the Beetles belonging to this section the antennæ are short and slender, and have a short basal joint. The head is deeply sunk into the thorax, the elytra cover the sides of the abdomen, and the last joint but one of the tarsus has two lobes. They are all vegetable-feeders, and, as most of them are attached to certain plants, there is little difficulty in finding them.

Passing by the family of the Sagridæ, of which we have but four species in England, all belonging to one genus, we begin with the Donaciadæ. In this family the antennæ are longer than is usually the case with the Eupoda, and they are set just in front of the eyes. The head is large in front and narrowed behind, and the first segment of the abdomen is very long. Our example of this family belongs to the typical genus, and is known to entomologists by the name of *Donacia menyanthidis*, a figure of which is given on Woodcut XXII. Fig. 1. In this genus the body is flattened, polished, and shining above, thickly punctured, and having altogether a metallic aspect. Below, it is covered with a very fine down. The antennæ have the fourth and following joints elongated, as may be seen by reference to the same woodcut, Fig. *e*.

All the Donaciæ may be found on water-plants, especially on reeds, from which they derive the generic name, *Donax* being a Greek word, signifying a reed. Although some of the species

are rather rare, the *Donaciæ* are, beyond comparison, the most common of water-frequenting Beetles, and the leaves of reeds, water-lilies, and other plants are often studded with these beautiful insects, whose polished and variously-coloured bodies glitter in the sunbeams like living gems. As many of the species are exceedingly variable in colour, it will be as well for



1. *Donacia Menyanthidis*. 2. *Crioceris merdigera*. 3. *Chrysomela Staphylea*. 4. *Cryptocephalus coryli*. 5. *Timarcha laevigata*. a. *Chrysomela*, antenna. b. *Cryptocephalus*, antenna. c. *Cryptocephalus*, labial palpi. d. *Cryptocephalus*, maxillary palpus. e. *Donacia*, antenna. f. *Crioceris*, antenna.

the entomologist to procure a considerable number of specimens, many, which at first sight appear to be different species, being, when closely examined, seen to be nothing but varieties of the same species. There is scarcely a colour of the rainbow which is not exhibited by one or other of the *Donaciæ*, and in some instances the same species exhibits an astonishing variety of colour—one being perhaps almost black, another blue,

another green, another copper, another purple, another red, while another is as made of burnished gold.

The larvæ of these Beetles live within the stems of the various water-plants, and on that account the species have derived their names from the plants on which they live. One species, for example, takes its name from the bog-bean, or yellow water-lily (*Menyanthes nymphæoides*), on which it is found. Another is named *Donacia typhæ*, from the common bull-rush or reed-mace (*Typha latifolia*). Another has the name of *Donacia sagittaria*, from the arrow-head (*Sagittaria sagittifolia*); and so forth. Altogether, exclusive of varieties, of which there are a great number, nineteen British species of this beautiful genus are known. In some places these Beetles are so plentiful that seven species have been found on water-plants within the limits of one small pond.

The present species is shining-green above with a brassy gloss, and below it is silvery-white, owing to the soft down with which it is clothed. There is a bold groove on the front of the head, and the elytra are both striated and 'crenated,' i.e. covered with little marks formed like segments of circles. It is not a very common species, being rather confined to certain localities.

THE next insect on our list is that which is shown on Woodcut XXII. Fig. 2, and is known by the name of *Crioceris merdigera*. It belongs to another family, the Crioceridæ. In this family, the outlines of the eyes are notched, and the antennæ are set in front, within the inner margin. The mandibles are short and abrupt at the tip, and have several sharp teeth. The genus *Crioceris* has the palpi slender, the joints of the antennæ short, and the elytra wide. The name *Crioceris* is formed from two Greek words, signifying 'ram-horned,' and is given to the insects on account of the form of the antennæ.

Only three English species of this genus are known, of which the insect which is shown on the illustration is by far the most remarkable. Its colour is bright scarlet, but unfortunately, as is the case with many brilliant insects, the colour only exists during life, and fades rapidly after death. This fading is generally caused by want of moisture, and in some cases has been checked, if not altogether stopped, by opening

the insect, and introducing a small quantity of glycerine into the body and under the elytra. This plan might be tried on the present species, and certainly would do no harm even if it did not succeed. The insect is a very rare one, but may be taken in the flowers of lilies.

The larva of this species feeds on lily leaves, and is possessed of a habit which, though very remarkable, is found in other Beetles belonging to the Eupoda. The digestive apparatus is so formed, that the excrements, instead of being dropped, as is the case with most animals, are pushed upon the back, where they soon dry, and form a covering which protects the larva equally against the sun and the rain. The larva has the power of freeing itself at will from this very singular covering. When full-fed, the larva descends to the earth, into which it burrows, and there makes an oval cocoon in which it undergoes its changes.

THE best known species of this genus is the ASPARAGUS BEETLE (*Crioceris asparagi*), which feeds on the plant from which it derives its name. This insect is much longer in the body than the preceding species, though smaller in point of size. It is very prettily coloured, the thorax being deep-red, and the head and elytra shining-blue or green-black, the latter being marked with reddish-yellow, so as to look as if they were yellow on which a black cross had been laid. The larvæ are grey, soft-bodied creatures, and, together with the perfect insect, can be found in any number upon the asparagus after it has been allowed to run to seed, and wave its feathery branches and pretty round fruit in the air.

THE family of the Cryptocephalidæ is represented by *Cryptocephalus coryli*, which is shown on Woodcut XXII. Fig. 4. In this family, the head is so deeply sunk in the thorax that it is quite invisible from above, a peculiarity which has earned for the insects their name, which signifies 'hidden-head.' The body is rather cylindrical and black, the antennæ are slender, and the eyes are kidney-shaped. The genus *Cryptocephalus* has the antennæ slender, and as long as the body. One of these antennæ is shown at Fig. *b* of the same illustration, the labium at *c*, and the maxilla palpus at *d*.

Many of the species of *Cryptocephalus* are very common, but, plentiful though they be, cannot be taken without some trouble and a perfect knowledge of their habits. They are the wariest of insects, and at the approach of the would-be captor they fall from the leaves on which they have been reposing, and allow themselves to drop to the ground.

I do not know a more irritating habit than this. Many of our wariest insects take to the wing at the slightest alarm; but in that case there is some hope of capturing them in fair chase, and the excitement of the hunt affords some compensation for the difficulty of capture. But when a little Beetle simply lets itself fall among the thick herbage and underwood, where even the sharpest eye can scarcely distinguish it, nothing can be more annoying to the entomologist who was in hopes of an easy capture. These lovely little Beetles give excellent practice to the young entomologist in the art of approaching insects. They will take alarm if he moves with a hasty or noisy tread, and they will be sure to drop among the underwood if he allows even the shadow of himself or his net to fall across them. Moreover, as befits their splendid clothing, they are creatures of light and warmth, and always bask in the sunshine, so that it is no easy matter to come within reach of them, and yet to avoid throwing a shadow upon them.

The larvæ of these Beetles envelope themselves in a curious pear-shaped cell, which seems to be formed from the same materials as the covering of the larva of *Crioceris merdigera*, described on page 206. These lovely little Beetles are of various colours, among which green and blue are the most common. The present species is remarkable for the distinction in colour between the sexes—the thorax being black in the male insect, and red in the female. The head is black with a few yellowish spots on the front, and the elytra are red, and covered with punctures arranged in irregular lines. As the specific name implies, it feeds on the hazel (*Corylus avellana*), and it has been taken upon the leaves of that tree in Darent Wood, and in Norfolk. It is a very rare species. At least twenty species of *Cryptocephalus* are known in England, but many additions are likely to be made through the rapid extension of entomological knowledge, and the almost daily increase in number of insect-hunters.

Now we come to a family in which most of the species are brilliantly coloured; and even those in which the hue is apparently of a sombre cast are seen, when closely examined, to be really clothed with as much beauty as their more conspicuous relatives. This family is called the Chrysomelidæ, a name which is composed of two Greek words, signifying 'golden apple,' and is appropriately given to these Beetles on account of the globular shape of their bodies, and the lovely tints with which they are adorned. In these Beetles the head is very far sunk in the thorax, but not so deeply as in the last-mentioned family, and the antennæ are stouter, shorter, and more thickened towards the tip. One of these antennæ is shown on Woodcut XXII. Fig. *a*. The body is oval or round, and the legs are of equal size. In the genus *Timarcha*, from which our example is taken, the wings are not developed, and the elytra are firmly soldered together at the suture, so that they cannot be opened.

On Woodcut XXII. Fig. 5, is represented an insect which is very plentiful, and known by the name of *Timarcha lævigata*. It is better known, however, by the popular name of BLOODY-NOSE BEETLE, because it has a habit of ejecting a large drop of red fluid from its mouth when it is handled. There are only two British species belonging to this genus, and they are by far the largest English representatives of the Chrysomelidæ. The present species sometimes nearly reaches a length of three-quarters of an inch, and, as the body is very stout and globular, it may take rank among the larger British Beetles.

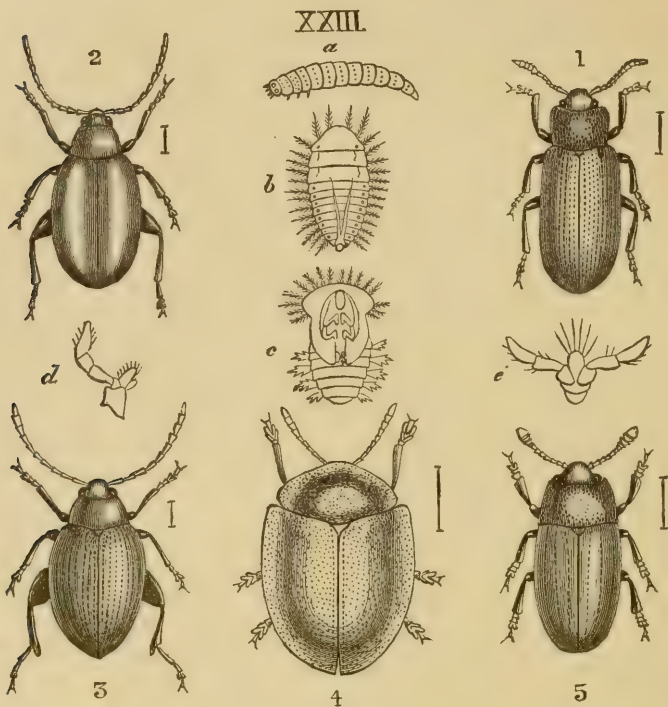
At the first glance, this insect appears to be black, but a careful examination with a magnifying glass, aided by a strong light, shows that the real colour is the deepest indigo-purple, sometimes with a gloss of green. The whole of the upper surface is thickly covered with small punctures, which impart to it a sort of velvety gloss. The tarsi are very broad, and furnished beneath with thick, greyish-yellow pads. There is a very broad impression on the forehead. The second species, *Timarcha coriacea*, much resembles the present insect. It is not, however, so large, and is rather blacker above. The chief distinction, however, is to be found in the punctures of the elytra, which are deep, and have a tendency to run together, so as to form irregular lines. This formation cannot be seen without the use of a magnifying glass.

The larva of this Bloody-Nose Beetle is wonderfully like the perfect insect. It is large, heavy, soft-bodied, and covered with a shining blue or green skin, a yellowish patch appearing at the apex of the body. It is very common in the ditches under hedgerows, especially if the hedge be allowed to flourish in the luxuriant and picturesque manner which is so fascinating to an artistic eye, and so hateful to the agricultural eye of the farmer, who cares nothing for beauty, and would sacrifice the loveliest country scene in England to get another cart-load of turnips out of his field. How these great, sluggish, conspicuous larvæ ever escape the many perils of larval life is really wonderful. I can only account for their survival on the supposition that they are distasteful to the insect-eating birds. Very many larvæ of this section secrete a bitter, or acrid liquid, and the *Timarcha* larva may perhaps be protected by some such means.

ON Woodcut XXII. Fig. 3, is represented a member of the typical genus, *Chrysomela staphylea*. In this genus the wings are fully developed, and the last joint of the palpi is rather hatchet-shaped. The present species is a moderately large one, and has the body extremely convex. The general colour is reddish-brown with a slight metallic gloss. The whole upper surface is covered with punctures, those of the head and thorax being very fine, and those of the elytra large and irregularly disposed. Beneath, the body is pale-brown. There are about twenty British species of this beautiful genus. The present species takes its name from the common Bladder-nut (*Staphylea pinnata*), upon which it can be found. It is a very common insect.

WE will take one more example of this family, namely, the insect which is represented on Woodcut XXIII. Fig. 1, and is known to entomologists by the name of *Prasocuris* [or *Helodes*] *beccabungæ*. In this genus the body is rather elongated, the wings are developed, and the thorax is squared. This beautiful little insect is found on the plant sometimes called the Brooklime, or Short-leaved Water Speedwell (*Veronica beccabungæ*), that is so plentiful in running streams, its thick fleshy stems reclining upon the water and just upholding its pretty blue flower.

The colour of the Beetle is bright polished-blue above, sometimes taking a deep-green hue, and there is a reddish patch below at the apex of the body. The thorax is rather convex and thickly punctured, and on each elytron there are ten rows of striæ, the intervals between them being very finely wrinkled. The insect is common in some localities, but in



1. *Prasocuris beccabungæ*. 2. *Phyllotreta brassicæ*. 3. *Psylliodes hyoscyami*. 4. *Cassida viridis*. 5. *Triplax russica*. a. *Phyllotreta*, larva. b. *Cassida*, larva. c. *Cassida*, pupa. d. *Cassida*, maxillary palpus. e. *Cassida*, labial palpi.

others seems to be rather scarce—its rarity or plenty depending, in all probability, on the presence or absence of the herb on which it generally feeds. There are five British species of this genus.

PASSING by the family of the Galerucidæ, we come to the enormous family of the Halticidæ, the members of which,

though individually small and insignificant, collectively exercise very great influence upon the agriculture of our country. One of these insects is shown on Woodcut XXIII. Fig. 2, and is one of several Beetles which are known by the popular name of TURNIP-FLEAS or HOPPERS. It is called scientifically *Phyllotreta* (or *Haltica*) *brassicæ*.

All the Halticidæ can be distinguished by the very thick hinder femora, which denote the possession of great leaping powers on the part of the insect. The antennæ are set between the eyes, and the edges of the elytra are wavy. They are attached to different plants, and are so constant to them that their specific names are often taken from their food-plant. The colour of the present species is deep-black, and there are two longitudinal yellow streaks upon each of the elytra, one near the base, and the other towards the apex. The body is egg-shaped, and the elytra are rounded at their tips. It is about the smallest species of the genus.

The true Turnip-flea is another species, called *Phyllotreta nemorum*, the colour of which is black, with a broad longitudinal yellow streak running nearly, but not quite, to the end of the elytra. Both in the larval and perfect stages this insect is extremely damaging to the turnips, feeding upon the first tender shoots as they appear above the ground, and so destroying the whole plant. Sometimes they will devastate a field so completely, that it must be re-sown if a crop be wanted. The early life of this Beetle has been well told by Mr. Le Keux, in the 'Transactions of the Entomological Society,' vol. ii. After narrating the destruction which these insects had wrought, he proceeds as follows :—

‘Being still at fault as to the origin of the larvæ, I captured ten males and ten females in pairs, and enclosed them in a glass tube covered at each end with wire gauze, into which I introduced a single leaf of turnip, with water to keep it fresh; by this means I was enabled to examine the insects and leaf on all sides with a magnifying-glass at any time without disturbing them. Having, previous to introducing the leaf, ascertained with a strong magnifier that there were no eggs or larvæ upon it, on the following day I had the satisfaction to perceive five small, smooth, oval-shaped eggs adhering to the under side of the leaf, and so nearly resembling it in

colour, that I was no longer surprised that they should hitherto have escaped my observation.

‘This leaf was removed with the eggs upon it, and placed in water, and its place supplied by a fresh one, which, on the following day, had three eggs upon it, and the third leaf four eggs, each of which leaves was placed separately in water. The fourth leaf I suffered to remain with the insects a week, supplying it with fresh water daily, and at the end of that time it had thirty-one eggs upon it. In two other glass tubes I confined single pairs of insects, with a leaf in each, upon which I never found more than a single egg deposited on the same day, and in those leaves taken from the field with larvæ in them (some containing six), no two of them were of the same growth.

‘I found great difficulty in preserving the leaves during the length of time necessary for the hatching of the eggs; and as it would have been impossible to have preserved them long enough for the feeding of the larvæ, I began to despair of success, until I observed that, in those leaves taken with larvæ in them from the field, it was not uncommon for the larva to leave the burrow it had first commenced, and, travelling (which from its formation I had supposed it incapable of doing) to a distant part of the leaf, form a new one. About the time, therefore, when I expected the eggs to hatch, I placed fresh leaves by the side of the old ones, to which the young larvæ soon found their way, and lodged themselves.

‘The egg hatches in ten days from the time it is laid, and the larva immediately begins to eat its way into the leaf and form a burrow by feeding upon the pulp between the upper and under surface of the leaf, which, however, is not easily perceptible to the eye unless held up against the light, although the track is sufficiently obvious after the larva has left it and it has become dry. The larva is full-fed and goes into the earth at the end of sixteen days, burying itself about an inch and a half below the surface, and in such a situation that the turnip-leaf above may afford shelter in case of rain. I have reason to believe that it remains in the earth about a fortnight before changing into the perfect Beetle. Some of the first specimens of larvæ and pupæ which I took in the field I placed in finely pulverised and very dry earth, and in a

few days they were shrivelled up. The others I also put into fine earth, and saturated it with water. Unfortunately, there was no opening at the bottom of the cup; and the next day, perceiving that the earth was still saturated with water, I drained it and removed the larva, but they were all dead. This accident may serve to account for the scarcity of the insects after very wet seasons.'

The result of this and other experiments is, that the insects are in all probability attracted to their food-plant by scent; and, as they have large wings which they can use well, it is impossible to keep them out of a field which contains their favourite food. Mr. E. Newman suggests that all weeds should be cut, dried, and kept in heaps until the Beetles are on the wing, when they should be placed in heaps on the windward side of the field and lighted, so that the smoke—strengthened with a little sulphur—may blow over the ground and repel the Beetles. If they can be kept off for a time, the plant gains strength, and then the Beetles cannot kill it, though they may seriously damage it.

The name *Phyllotreta* is of Greek origin, and signifies 'leaf-borer.' There are more than a hundred British species of these little Beetles, and the now restricted genus *Phyllotreta* contains thirteen species. The larva of this Beetle is shown on Woodcut XXIII. Fig. *a*.

ANOTHER example of this family is shown on Woodcut XXIII. Fig. 3. Its name is *Psylliodes hyoscyami*. There is a curious structure in the antennæ of the insects belonging to this genus—the second and third joints being so fused together as to form one long joint. The tibiæ of the hind legs are abruptly sloped at the end, and the tarsi are set on the upper edge and above the apex. The colour of this Beetle is green above and black below, a brassy gloss covering the whole of the surface. The large hinder femora are black, and the whole of the upper surface is thickly punctured, the punctures being arranged in striæ on the elytra. It is not a very common insect.

WE now pass to the family of the Cassidiidæ, commonly known by the popular and appropriate name of TORTOISE

BEETLES. There is no possibility of mistaking these Beetles, which are flat-bodied, rounded, and have the head completely hidden under the wide thorax, which overlaps the base of the elytra. As the insects sit upon leaves, the whole of the head and limbs are completely hidden by the thorax and elytra, just as are those of a tortoise by its shell. Most of the species are green, though some of them are adorned with spots and stripes of red and gold. All these colours are exceedingly fugitive, and vanish soon after the death of the insect. Glycerine has been tried with some of these insects, as mentioned on page 206.

A very common species, *Cassida viridis*, is shown on Woodcut XXIII. Fig. 4. It is of a rather dull-green colour, the base of the elytra taking a slightly reddish hue. It may be found plentifully on thistles.

At Fig. *b* of the same illustration is shown the extraordinary larva of the Tortoise Beetle. It is very flat, and has the sides covered with flattened spines. But the most curious portion of its structure is the forked apparatus that proceeds from its tail and passes over its back. This fork serves a very curious purpose. Like the larva of *Crioceris merdigera*, which has been described on p. 206, this creature is sheltered by a sort of umbrella formed of the same materials as those of *Crioceris*. But, instead of lying directly on the back, the umbrella is supported on the fork at some little distance from the body, and, when it becomes too weighty, it can be shaken off and a new one gradually produced. The pupa is scarcely less curious in appearance, and is drawn at Fig. *c*, Woodcut XXIII. The maxilla of the perfect insect is shown at *d*, and the labium at *e*.

There is only one British genus of this family, and it contains about thirteen species. One of the variegated species is shown on Plate VI. Fig. 11. Its name is *Cassida murræa*, and its colour is sometimes red and sometimes green, blotched with black near the suture and spotted with the same colour on the disc.

CHAPTER XIV.

PSEUDOTRIMERA.

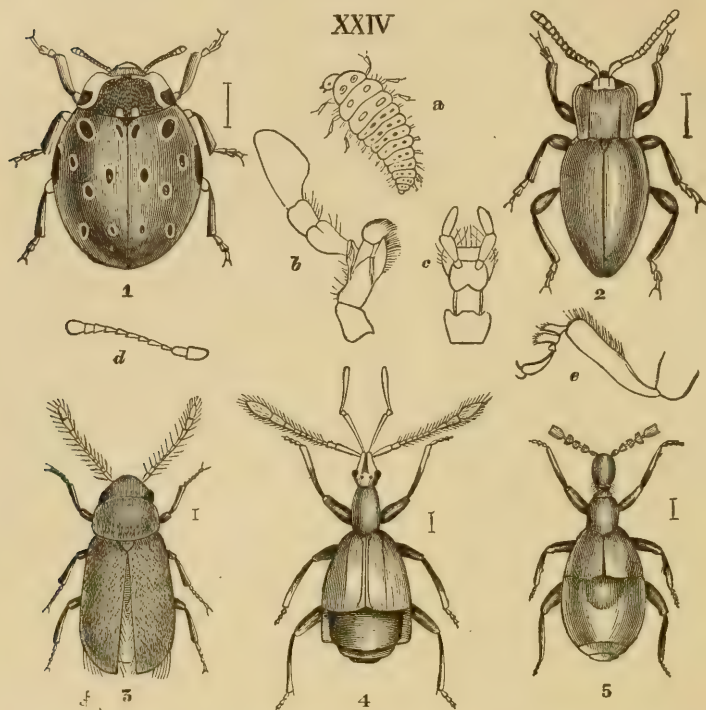
WE now come to the last section of the Beetles, the PSEUDOTRIMERA. This name is compounded of three Greek words, signifying 'false three-joints,' and is given to the insects on account of the structure of their tarsi, which appear to have only three joints, though in reality they have four joints; the missing joint, which is the third, being very minute, and hidden within the doubly-lobed second joint. This structure can be seen by reference to Woodcut XXIV. Fig. *e*, which represents the leg of a Lady-bird.

The first family of these Beetles, the Erotylidæ, can be distinguished by the bold three-jointed club of the antennæ, and the large flattened club-shaped last joint of the maxillary palpi. One example of this family is *Triplax russica*, which is represented on Woodcut XXIII. Fig. 5. In this genus the body is oblong and the antennæ rather stout, and the club has the last joint blunt and egg-shaped, and the other two joints transverse. The generic name, *Triplax*, is formed from two Greek words, signifying 'three-plated,' and is given to this genus on account of this structure of the club.

The present species is the largest of the genus, although it never exceeds a quarter of an inch in length. The head and thorax of this insect are red, and the elytra are deep blue-black. The abdomen is reddish, and the whole surface is shining. All the species of this genus live in fungi; and in such localities may be found this insect, which is not very common, but is more plentiful than seems to be the case on account of its way of hiding itself within the fungi. There is another genus belonging to this family, called *Engis*, the members of which are found in similar localities. They are pretty little beings—shining, rather convex, and elongated, and usually dark-

brown with yellow thorax and shoulders. The peculiar three-jointed club of the family will at once distinguish them. The genus *Triplax* contains five English species.

THE next family, the *Coccinellidæ*, is composed of insects which are very familiar to us under the popular name of Lady-



1. *Coccinella ocellata*. 2. *Lycoperdina bovistæ*. 3. *Trichopteryx atomaria*. 4. *Pselaphus Heisei*. 5. *Claviger foveolatus*. *a.* *Coccinella*, larva. *b.* *Coccinella*, maxillary palpus. *c.* *Coccinella*, labium. *d.* *Coccinella*, antenna. *e.* *Coccinella*, leg.

birds or Lady-cows—the former being the more common as well as the more poetical name. These insects are all flat below and convex above, the body is rounded and the antennæ are short. The structure of the various parts of this genus is shown on Woodcut XXIV., the antenna being represented at *d*, the maxilla and its palpus at *b*, the labium at *c*, and the leg, with the tiny third joint of the tarsus, at *e*. The typical

genus, *Coccinella*, has the hinder angles of the thorax acute. Many species of these pretty insects inhabit England, but some of the species are so exceedingly variable in point of colour, that the varieties have been described as actual species by practised entomologists. It is common enough to find a blue insect running into shades of green, and *vice versâ*; but in some of these Lady-birds, the same species will be red spotted with black, black spotted or blotched with red, black spotted with yellow, yellow spotted and barred or blotched with black, and so on in infinite variety.

We will now briefly describe two species, one a rarity and the other a very common one, and then proceed to the habits of the insect. On Woodcut XXIV. Fig. 1, is represented a very beautiful insect, which we may call the EYED LADY-BIRD (*Coccinella ocellata*). The head and thorax of this species are black, and on the latter are two yellow spots at the base and a patch of the same colour at each side. The elytra are red, and upon each elytron are nine black spots, more or less oval, each of them surrounded with a ring of yellow, giving them the 'eyed' appearance which is expressed by the specific name *ocellata*. There is also a black, yellow-edged streak over the apex of the elytra. Several varieties of colouring are known. This insect has been found upon the pine, the fir, and the beech.

On Plate VI. Fig. 12, is drawn the common SEVEN-SPOT LADY-BIRD (*Coccinella septempunctata*), a species that derives its name from the seven black spots upon the elytra. These spots are exceedingly variable in size, and sometimes one or two spots are absent, while there is one variety in which there are no spots at all. It is represented in flight, in order to show the large size of its wings.

Beautiful as are the Lady-birds, it is not for their beauty alone that they are valued, inasmuch as they are among the greatest benefactors of civilised man, and preserve many a harvest which, but for their aid, would be hopelessly lost. For, in their larval state they feed upon the aphides—the 'green blight' or 'green-fly' of gardeners—and, being exceedingly voracious, devour vast numbers of those destructive insects. Few persons would suppose, on looking at the *Coccinella* larva, what was its real condition of life. It looks as harmless, dull,

sluggish a creature as can be imagined, and much more likely to be eaten itself than to eat other insects. Yet, with all this innocence of aspect, it is so ruthless a destroyer of animal life, that if a few of them be placed on a bush or plant which is infested with aphides, in a day or two not an aphid will be left.

Especially is the Lady-bird useful in those parts of the country where hops are grown. There is an aphid which feeds specially upon this plant, and which has been known to destroy whole plantations in a single season, causing the greatest distress among the multitudes whose living depends more or less directly upon the hop. Fortunately, the Lady-bird—usually the little Two-SPOT LADY-BIRD (*Coccinella bipunctata*)—comes to the rescue, and follows the aphides wherever they are most plentiful. The mother insect lays her eggs in packets among the aphides, and, as soon as the young larvæ are able to move about, they begin to feed upon the insects near where they have been placed.

In some seasons the swarms of Lady-birds almost exceed belief. I have seen the streets absolutely red with them, and the houses covered with their multitudes, while within doors a thick band of Lady-birds ran along the angle of the walls and ceiling like a red cable, large bunches hanging in each corner. These insects very well illustrated the adage that ‘dirt is only matter in the wrong place.’ Nothing could be more beneficial than their presence in the locality, as it was situated in the very midst of hop gardens, and by their means the year’s harvest was saved from destruction. But, though they were very much wanted out of doors, they were not at all wanted inside the house, especially as Lady-birds have a very unpleasant odour, which, when multiplied by tens of thousands, becomes almost unbearable. Even after the rooms had been cleared, they were almost uninhabitable, and the more so that it was impossible to keep the windows open, because the Lady-birds flocked into the room in swarms, and would soon have replaced those which had been ejected. Even throughout the winter many of them retained their positions, having been kept alive by the warmth of the fire.

When the larva is full-fed, it attaches itself to a twig or leaf by the end of its tail, and thus hangs with its head downwards.

Presently, the larval skin splits down the back, but the pupa does not emerge, remaining within the larval skin until it has changed into its perfect form. It has been mentioned that the Lady-birds give out a very unpleasant odour. This is caused by a yellowish liquid which issues from the joints of the limbs, as has been described in connection with the Oil Beetle, on page 154, and which has a very powerful and disagreeable scent. In some parts of the country this liquid is considered to be a cure for toothache, the finger being first rubbed against the legs of the Lady-bird, and then on the offending tooth. In its larval state it emits a similar liquid from the tubercles upon its body.

It is rather remarkable that the popular names of Lady-bird and Lady-cow are not peculiar to England. In France, for example, the insect is called *Bête de la Vierge*, or *Vache à Dieu*. The children, however, do not respect the insect in consequence of its popular names, but, on the contrary, when they catch one, look upon it as a means of showing their ingenuity in prolonging torture without destroying life.

THE next family, that of the Endomychidæ, is represented by one species, *Lycoperdina bovistæ*, which is shown on Woodcut XXIV. Fig. 2.

In this family the antennæ are tolerably long, the thorax is impressed behind, and the last joint of the maxillary palpus is never hatchet-shaped. In the genus *Lycoperdina* the thorax is heart-shaped, and abruptly cut off at the base, and there is no distinct club to the antennæ. The present species is an odd, black, flat insect, which has been very happily compared to a *Blaps* in miniature. It is to be found inside the well-known puff-ball (*Lycoperdon bovistæ*), from which it derives its generic name, and makes its exit by the aperture which exists at the top of the fungus, and through which the spores escape like clouds of smoke. It is not at all a common insect, and a vast number of puff-balls may be examined without a single specimen of the Beetle being found. But, like many other rare insects, when one specimen is found, plenty more are generally to be seen, and though five hundred of the fungi may have been examined without success, the five hundred and first may contain enough Beetles to stock a dozen cabinets.

The wide and deeply fringed maxilla is worthy of notice. This is the only English species of the genus, the second supposed species being nothing more than a variety.

THE family of the Trichopteridæ contains a good many species, of which we select one as our example. This is *Trichopteryx atomaria*, which is represented on Woodcut XXIV. Fig. 3.

These are all little Beetles, and, indeed, are the tiniest of the British Coleoptera. Small as they are, they can be easily recognised when examined by the aid of a lens, so bold are the characteristics which mark them. The antennæ are long, slender, and beset with long hairs, and having a bold three-jointed club. The wings are very long and narrow, and fringed with hairs, a peculiarity which has gained for them the name of Trichopteryx, or 'hairy wings.' Sometimes the wings are undeveloped, but when they are present they are always fringed with hair. There are other characteristics of the family, but these are sufficient for the recognition of any insect that belongs to it.

In the typical genus, Trichopteryx, the antennæ are about half as long as the body, the head is convex, large and triangular, and the wings are furnished at their tips with several bundles of hairs. The present species is one of the largest of the family, and yet it is only one twenty-fourth of an inch in length. Small as it is, by the side of other species of the same genus it is only a giant, most being the thirty-sixth part of an inch in length, while there are some which are barely one-hundredth of an inch long. Some notion of the size of these tiny creatures may be obtained by looking at the little line on the right hand of Fig. 3, and reflecting that they measure just one quarter of that length.

The little insect which has been chosen as our example of these 'micro-coleoptera,' as the tiny Beetles are called, is tolerably common, and can be found under heaps of decaying leaf-mould and similar localities. Though the finder may not be able to recognise the precise species when he discovers it, he can at all events see that it is a Beetle, whereas, when he finds the exceedingly minute creatures which have just been mentioned, it is impossible for him to know, without the aid

of a lens, that the little black speck is even an insect, much less whether it be a Beetle or not. The best mode of capturing these Beetles is to take some leaf-mould from under a heap, scatter it thinly on a sheet of white paper, and then go over it carefully with a tolerably powerful lens.

Owing to the very minute dimensions of these Beetles, the exact definition of the species is a very difficult business, but it is estimated that twelve species are known in this country.

PASSING by one family of this section, we come to the Pselaphidæ, of which remarkable family two examples will be given, each illustrating one of the sub-families.

In these Beetles the elytra are very short, so short, indeed, that for many years these insects were classed among the Brachelytra. The club of the antennæ is bold and well-defined, the last joint being very large. The head is narrowed behind into a distinct neck.

The first sub-family is called the Pselaphinæ, and in them the antennæ have eleven joints, and the eyes and parts of the mouth are well developed. The genus *Pselaphus*, of which there are only two British species, has the antennæ, palpi and legs very long. The commonest species, *Pselaphus Heisei*, which is represented on Woodcut XXIV. Fig. 4, is shining yellow-brown, has its body very flat and wide, and on each side of the suture of the elytra there is a stria which runs from the base to the tip. It can be shaken out of moss, as can its congener, *Pselaphus Dresdenensis*, which may be distinguished by its dark colour and a semicircular impression at the base of the thorax.

THE last example of the British Beetles is, perhaps, the strangest of all our native insects, and how it can find any gratification in existence is not easy to see. We think that the life of a deaf and dumb man is a hard one, shut out as he is from free intercourse with his fellow creatures, and incapable of enjoying, or even of comprehending, the common blessings of sight and hearing. Yet he is capable of one kind of animal enjoyment, for he can eat, and indeed upon this capability is based the course of instruction by which such afflicted persons have been rescued from their wretched isolation, and

taught to interchange ideas with their fellow men. But, supposing that a man who was incapable of sight or hearing were also found without a mouth, and yet possessing the power of living without food, we should think that such a being must have reached the very abyss of misery—a misery beyond all power of alleviation.

Yet in the Beetle which is shown on Woodcut XXIV. Fig. 5, we see an insect in which these imaginary privations are the normal state, and which possesses neither eyes nor mouth, and is capable of supporting existence without food. We should, however, be very wrong in supposing that this insect must be miserable because a human being under such conditions would be supremely wretched, and may be sure that, in some mysterious way, this Beetle, which leads a darkling life and is incapable of eating, is just as happy in its way as the brilliant butterfly that basks in the sunshine, and flits from flower to flower, enjoying their lovely colours and sweet juices.

Whether the insect be possessed of some senses unknown to us, must of necessity be a problem not likely to be solved, but, as far as we can judge, the only sense which it can possess is that of touch. The name *Pselaphidæ* refers to this supposition, and is formed from a Greek word, signifying the groping movements of one who tries to find his way in the dark.

The name of this Beetle is *Claviger foveolatus*, the former name signifying ‘club-bearer,’ and given to the insect on account of the form of the antenna, which is boldly clubbed, and has only five joints. This Beetle can be found in the nests of the yellow ant (*Formica flava*), a very common insect, which makes its nests under large stones if it can find them, or, in default of such shelter, throws up little mounds of earth. It can be found plentifully on heaths and hilly districts. The colour of the insect is yellow, like that of the ant with which it lives, and it has no wings. The name *foveolatus* is given to it on account of the deep fovea, or hollow, in the middle of the abdomen.

DERMAPTERA.



DERMAPTERA.

CHAPTER I.

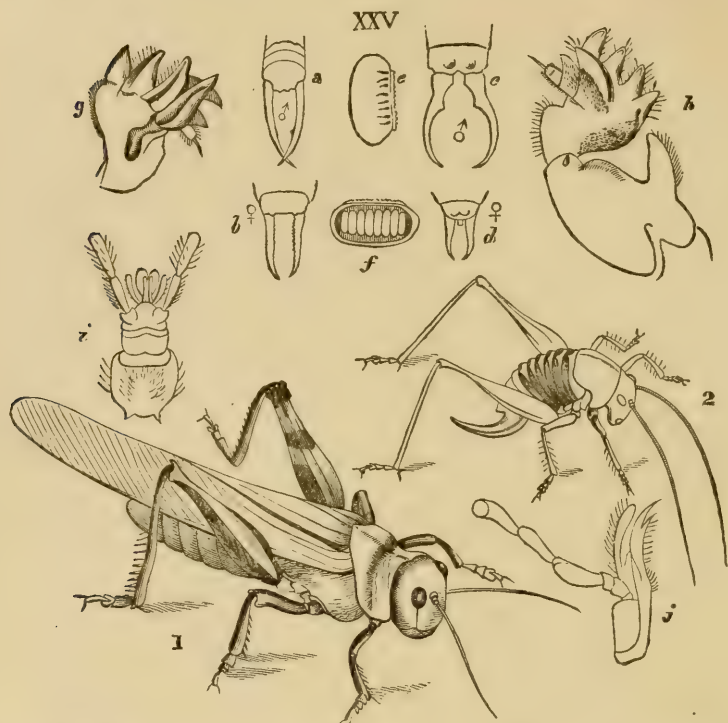
THESE insects, popularly known as EARWIGS, are remarkable for many reasons. None of them are large, and some are very small. There are but few species, and most of the British species are very common—in fact, much too common as far as flower-gardens are concerned. Yet, though they are small, few, and common, they have been the occasion of more disputes among entomologists than all the other insects put together. Some asserted that they were an ‘aberrant’ branch of the Brachelytra and allied to the common Rove Beetles, while others as strenuously asserted that they belonged by right to the Orthoptera, and were allied, though distantly, to the Cockroach. The use to which they put the forceps with which their tails are armed furnished another fertile source of dispute, while even their popular English name was cause for abundant quarrel—one party considering the name to be properly *Earwig*, in allusion to the popular idea that they were in the habit of crawling into human ears; and the other spelling the word *Earwing*, because the spread wing of the insect is shaped like a human ear.

We will take each of these disputed points in succession, and begin with the first—namely, the position which they ought to occupy in the world of insects.

It is satisfactorily ascertained that they cannot be Beetles, if only for the one fact, that in the pupal state they are not inactive, but resemble in every respect the perfect insect, except that the wings are rudimentary. The elytra, instead of being horny, are soft and leathery, very small, without veins; and nearly, but not quite, cover the wings, the leathery hinge of which projects just beyond them when folded. This hinge

is a most important part of the wing, and will be presently described more fully. The name DERMAPTERA is formed from two Greek words, signifying 'skin-winged,' and is given to these insects on account of the structure of the elytra.

As the wings form one of the most important characteristics in these insects, we will proceed to describe them. Very few



1. *Pachytulus migratorius*. 2. *Thamnotrizon cinereus*. a. Forceps of *Forficula gigantea*, male. b. Do. female. c. Do. *Forficula auricularia*, male. d. Do. female. e. *Blatta orientalis*, egg-case. f. Do. section. g. *Gryllotalpa*, inside of front tibia. h. Do. outside. i. Do. labium. j. Do. maxilla and palpus.

persons have the least idea that the Earwig is furnished with wings of remarkable size and beauty, and that, although it is possessed of much speed in running it is quite as active in the air as on foot. On Plate VII. Fig. 2, the COMMON EARWIG (*Forficula auricularia*) is shown, as it appears with its beautiful wings extended.

To display these wings properly is a business of exceeding difficulty, and demands the greatest patience as well as skill. They have to be coaxed from under the tiny elytra with infinite care, and their delicate folds spread one by one lest they should be torn. I have found that a glass tube, drawn to a rather fine point, is exceedingly useful, for the wings can often be blown open by a current of air directed upon them, when the use of a needle would be nearly certain to damage them. Even when they are at last 'teased' out, it is no easy matter to spread them flat and keep them so while the card braces are being pressed on them, inasmuch as the membrane, though delicate, is very elastic, and has a tendency to contract and crumple up the whole wing into folds, just as it has been nicely and satisfactorily flattened. If any of my readers should be afflicted with hasty tempers and wish to put themselves through a course of discipline, I can strongly recommend them to take a few Earwigs and set them with expanded wings, taking care to make both wings look alike. When they have succeeded in doing so without losing temper they may be perfectly easy as to their ability in conquering their infirmity.

The mode in which these large and delicate wings are packed into so small a compass is singularly beautiful. The front margin of the wing, from the base to a spot about half-way along it, is rather hard and firm, and at that point is a broad leathery patch which acts as a hinge. From this point the folds of the wing radiate just like those of an open fan; and, at half their length, the edge of each of these folds is strengthened by a small patch of similar leathery material.

When the wing is to be gathered together under its elytron, the radiating folds are closed exactly like the bars of a fan, and the closed folds are then doubled twice, once at the small and once at the large hinge. If we suppose each of the bars of a fan to have two hinges, so as to divide it into three equal parts, we can understand that it could be folded into a very small compass, first by closing the fan longitudinally, and then doubling it twice crosswise. In consequence of this beautiful piece of mechanism Mr. Westwood proposed the name *EUPLEXOPTERA* for the Earwigs, the name being of Greek origin, and signifying beautifully-folded wings.

I have mentioned that it is a very difficult task to get the

wings expanded. It is all but impossible to put them back again under the elytra. How, then, can the insect manage to replace them? This question involves the real use of the forceps at the end of the tail. They are generally considered as instruments of offence, and as such they can be used, being capable of inflicting a tolerably sharp pinch, as anyone can testify who has handled an Earwig. This, however, is not their primary use, for they are employed in the act of packing the wings under the elytra, and without their aid the insect could never secure its wings properly. I have more than once seen an Earwig pack up its wings, and a very curious and interesting sight it is.

As soon as the insect settles, it partially folds its wings, so that they fall into a set of wrinkles, apparently without any arrangement, but in reality—like the seeming confusion of ropes on board ship—each being exactly in its appointed place, and ready for the next movement. After a very brief pause, the folds of the wings are brought still closer together, and gathered towards the elytra; and then the tail is bent over the back, the wings are seized by the forceps, and by their aid are tucked away under the elytra.

It is said that the insect also makes use of the forceps in expanding the wings as well as in closing them. This may be the case, but I have never seen an Earwig use its forceps except for the latter office, the mere beat of the wings against the air seeming to have the power of spreading them to their full extent. In each case the species was the LITTLE EARWIG (*Labia minor*), and indeed I never did see the Common Earwig use its wings.

These insects are remarkable in many respects, and one species—whatever may be the case with the others—has been ascertained to behave very differently from the generality of the insect-race. As a rule insects take no care of their young. They deposit their eggs in some spot where the young larva can find its food when hatched, and then take no further care of them. Indeed, the greater number of insects die as soon as they have deposited their eggs, so that maternal care is impossible. It may be urged that bees, wasps, and ants take care of their young. This, however, is not the case. Care is certainly taken of the young larvæ, but not by the mother, who



PLATE VII.

EARWIGS, FIELD-COCKROACH, AND CRICKETS.

1. *Forficula gigantea*.
2. *Forficula auricularia*.
3. *Blatta germanica*.
4. *Blatta germanica* (egg-case).
5. *Gryllotalpa vulgaris*.
6. *Gryllus campestris*.

PLANTS:—

Great Bindweed (*Convolvulus sepium*). Above.

Purple Clover (*Trifolium pratense*). Right of Middle.



does nothing but deposit the eggs, and then leaves to the workers the task of feeding and nurturing the helpless young.

But, according to the observations of De Geer, the Earwig forms an honourable exception to this rule, and watches as carefully over the young as a hen does over her chickens. She deposits the eggs in some spot which is at the same time damp and moist, and if one of these conditions should fail shifts the eggs to another place. The same observer noticed that even after the eggs have been intentionally displaced the mother insect will collect and replace them. These curious statements have been corroborated by Mr. Spence, who writes as follows: 'This remarkable fact I have myself witnessed, having found an Earwig under a stone, which I accidentally turned over, sitting upon a cluster of young ones, just as this celebrated naturalist has described.'

The larvæ very much resemble in form the perfect insect, except that they have no wings, and the forceps are not well developed, the prongs being nearly straight and not possessing the bold curve which is seen in the perfect insect. In the pupal state the wing-cases make their appearance in a rudimentary form, but the wings are not developed until the insect has passed through its final change. Moreover, in the imperfect stages of life the Earwig has much fewer joints in the antennæ—the perfect insect of the common species having fourteen and the larva only eight.

Interesting as is the Earwig to the naturalist, it is specially hateful to the gardener. It has a very disagreeable habit of feeding on the petals of flowers, nibbling their edges and making them unsightly. The dahlia and the carnation are favourite flowers with the Earwig, and as a true and perfect edge forms one of the chief points in these flowers the gardener has good reason to hate the insect. As, moreover, the Earwigs as a rule feed by night it is no easy matter to guard the flowers from their depredations.

Disliking the light, Earwigs hide themselves by day in any dark cranny that they can find; and, by taking advantage of this habit, their numbers can be sensibly diminished, though they cannot be altogether extirpated. For this purpose, gardeners are in the habit of putting inverted flower-pots, lobster-

claws, and similar objects, on the tops of the sticks to which the plants are tied, so that the Earwigs may crawl into them at night and be captured in the morning. There is, however, a neater and more effective mode of catching these insects.

Instead of capping the tops of the sticks with such unsightly objects as lobster-claws and flower-pots, let a number of tubes be made, about three or four inches in length and half an inch or less in diameter. These may be made from elder branches, from wild hemlock stems, or even from brown paper. One end must be plugged up, and the tube is then hung to the stick with the open end downwards. In the morning, the tubes should be gently lifted from the sticks to which they are suspended, the plug removed, and the Earwigs blown into a convenient vessel, from which they can be thrown into boiling water. The plug is then replaced, and the tube allowed to hang in its former place.

These insects are able to devour both animal and vegetable food, though they seem to prefer the latter. They are said to enter the nests of certain solitary bees and to feed upon the larvæ; and De Geer remarked that the young Earwigs which he watched not only ate the bodies of their brethren who died, but ill repaid the watchful care of their mother by devouring her dead body.

Only a few species of Earwig are known in this country, and none of them attain any great size. The GIANT EARWIG, the largest and rarest of these insects, is represented on Plate VII. Fig. 1. Its name is *Labidura gigantea*, and, as Lord Lytton remarks, 'to the great grief of naturalists, and to the great honour of Providence, is very rarely found.' It was first discovered by the Rev. W. Bingley, in 1808, upon the beach near Christchurch. He observed that it seldom quits its place of refuge in the rocks during the daytime, but runs about the sands in search of food after the sun has gone down.

For many years, no other specimens of this fine insect were discovered, and some doubts were entertained as to the propriety of admitting it among the British insects. Of late years, however, its haunts have been known, so that Mr. Bingley's specimens were not the only examples. A good specimen in my collection was taken on the sands at Folkestone by a lady who had sufficient observation to see that the insect was a

peculiar one, sufficient courage to capture it, and sufficient discrimination to send it to me. It was caught in the afternoon, and I think that it must have been frightened out of its hiding-place by a little boy who was digging in the sand and getting into mischief, after the custom of children on the sea-shore.

By some entomologists this insect is placed in a separate genus on account of its antennæ, which have more than twice as many joints as those of the common species. The name *Labidura* is composed of two Greek words, signifying 'pincer-tail,' and is a very appropriate one, the forceps being of very great proportionate size. The name *Forficula*, which is given to the common species, is Latin, and signifies 'little forceps.'

As this instrument is so important, both in the economy of the insect and in deciding the species, the forceps of the two species which have been described are given on Woodcut XXV. At Fig. *a* is shown the forceps of the male Giant Earwig, and at Fig. *b* those of the female. Similarly, the forceps of the male Common Earwig are shown at Fig. *c*, and those of the female at *d*.

ORTHOPTERA.

ORTHOPTERA.

CHAPTER I.

THE word ORTHOPTERA signifies Straight-wings, and is given to this order of insects because their wings are not capable of being folded crosswise, as is the case with the Beetles and Earwigs. The elytra are soft, leathery, strongly veined, and cross each other at their tips, and the true wings are gathered under them in longitudinal folds, like those of a fan, the tips frequently projecting from under the elytra. The larvæ and pupæ resemble the perfect insect in shape, but do not possess wings, and the pupa has no quiescent stage, but is as active as the larvæ or perfect insect, therein differing essentially from the Beetles. In consequence of the soft texture of the wing-covers, some entomologists have suggested that the name 'tegmina' be substituted for 'elytra.' I cannot, however, admit the necessity for such alteration, and shall therefore retain the word elytra.

This order of insects is tolerably well represented in this country, and some of its members are so numerous and so disagreeable that we should be very glad to dispense with them altogether. Our English Orthoptera may be classed under the general terms of Cockroaches, Grasshoppers, and Crickets; while in other countries we find the strange 'Walking-stick' insects, Soothsayers, and Leaf-insects. A few examples will serve to illustrate the British Orthoptera.

MR. WESTWOOD divides all the Orthoptera into four sections. First come the Cursoria, or runners, of which the Cockroach is a familiar example. Then come the Raptoria, or snatchers, such as the Mantis or praying insect, which have the first pair of legs developed into instruments of prehension. The third

section is the Ambulatoria, or walkers, such as the Walking-stick insects; and the last section is the Saltatoria, or jumpers, such as the Grasshoppers and their kin.

The first section is represented in England by one genus only—namely, *Blatta*—and, considering the nature of the cursorial Orthoptera, we may be glad that they have no more representatives in this country. In these insects the body is rather oval and flat, the thorax is very large and shield-shaped, the head being almost concealed under it, and the antennæ are very long and thread-like. The males are fully winged, while in the females both wings and elytra are much smaller than in the male, and in some species are altogether absent. There are several species of Cockroach in this country, some of which are indigenous, while others have evidently been imported.

Such is the case with the DOMESTIC COCKROACH (*Blatta orientalis*), which has completely taken possession of England. As far as is known it was originally imported from the Levant, and at first was confined to seaport towns. The climate, however, suited it, and so did the prevalence of kitchen fires, which are allowed to smoulder through the greater portion of the night, thus affording the requisite supply of warmth. As for moisture, which is as necessary to the insects as warmth, the drippings of the kitchen boiler are generally sufficient for the purpose. However this may be, the insects have spread themselves over England in a manner which is really wonderful, considering that the female is wingless, and must therefore be transported by other means of locomotion than her own limbs can supply.

That the Cockroach should spread over London is easy to understand. London is a seaport town, and the insect could therefore establish itself firmly enough by the water-side, and afterwards make its way to different parts of the metropolis, a task in which it is greatly assisted by the laundress and her basket. Innocently and ignorantly the laundress is one of the principal agents in the dispersion of the Cockroach. Her washhouse, with its perpetual fire and water, is a very paradise for the Cockroach, which multiplies therein exceedingly, keeping itself hidden during the day, according to the wont of these light-hating insects. The laundress, having made up her basket of linen, goes off to her well-earned rest; and as

soon as the light is removed out come the Cockroaches in shoals, and hold revel all night in the warmth and wet of the room. In the morning they mostly retire to their hiding-places, but, if suddenly disturbed, scurry off to any place which can conceal them, and find the linen-baskets very convenient for the purpose. Hidden in the baskets, they are carried off to the various houses, where they escape and soon produce fresh colonies.

Still, though the Cockroach can be carried about London by the laundress, it cannot reach the interior of England by such means, and is in all probability imported in hampers, paper parcels, and boxes, having crept into them while the goods were waiting in the London offices.

Like many other insects, the Cockroach has a habit of discharging from its mouth a dark-coloured fluid which possesses a most abominable smell. This odour, indeed, is one of the principal reasons why the Cockroach is so universally detested, for every place which the insects frequent becomes in time impregnated with this nauseous odour, which sometimes is so powerful that it sensibly affects the flavour of provisions that have been left in larders in which the Cockroaches are specially plentiful. Yet, in spite of this odour, and possibly on account of it, the Cockroach is a favourite food with many animals, almost all insectivorous birds being fond of it, and the hedgehog being so partial to it that one of these animals is sometimes kept in the kitchen for the express purpose of destroying the Cockroaches.

I have even heard of a case where human beings have been free from the usual dislike of these insects. Some thirty years ago two young ladies, sisters, were at school in London, where they had been sent from Jamaica, their native place. After everyone but themselves was asleep they used to get up quietly, slip down into the kitchen, and there catch and eat the Cockroaches. This extraordinary habit was not detected for some time, but at last the mistress found it out, and remonstrated with them. They, however, defended themselves by saying that they had seen her eat shrimps, which fed upon all manner of carrion, whereas the Cockroaches were clean feeders, living on the crumbs which had been suffered to lie about in the kitchen. Even after the discovery it was almost im-

possible to keep them from the kitchen at night, so strong was their love for the Cockroaches.

In popular kitchen parlance these insects are called Black-beetles, though why they should have such a name, not being beetles and their colour being dark brown with a decided tinge of red in it, is not easy to see. I find on enquiry that in some bakehouses the males, which are distinguished by their wings, are called Cockroaches, while the wingless females are termed Black-beetles. As is the case with insects generally, the Cockroach, when it first emerges from its pupal skin, is almost white, the dark colour being attained by slow degrees. Wishing to know how long a period was required for the development of the dark hue, I tried the experiment by catching one of these 'white Black-beetles,' as the servants called it, and keeping it in my room under a glass cover. The dark colour was fully developed on the third day, but I fancy that a longer period would be required in the darkling recesses in which the insect loves to pass its life.

One of the most curious points about the Cockroach is the mode in which its eggs are deposited. The eggs of most insects are independent of each other, or at the most are attached to each other after they are deposited, and are either defended by being laid in some sheltered spot, by animal varnish with which they are covered, or, in a few instances, by an artificial covering placed over them by the mother insect. But the eggs of the Cockroach are differently constituted, and are laid all together, enveloped in a hard horny covering, in which they lie like peas in a pod. The technical name for this egg-case is *ootheca*, a word which signifies 'egg-purse.' The egg-case of the common Cockroach is shown in Woodcut XXV. Fig. *e*, and at *f* the same egg-case is drawn, but represented as laid open, so as to show the manner in which the eggs lie side by side in it.

This egg-case looks exactly like the kind of tart called popularly a 'turnover;' and indeed if the apple which is generally enclosed in the 'turnover' were cut into slices, and these slices arranged side by side, a very accurate copy of the egg-case would be made, the apple representing the eggs, and the crust the egg-case itself. These egg-cases vary in appearance according to the species of the insect which produced them.

That of the domestic species is wonderfully large considering the size of the insect, being three-eighths of an inch in length, and nearly half as much in width. It is shaped something like an oblong steel purse, the part which represents the purse itself being well rounded, and that which represents the clasp having a row of very fine notches. When the young are hatched, they escape through this portion of the egg-case, the whole side opening exactly like the clasp of a purse, and, owing to the elasticity of the material of which the case is composed, the opening closes as soon as the young have escaped, and externally the egg-case looks exactly as it did when the eggs were still in it.

If the empty case be cut open a curious sight presents itself. On the outside of the case are eight small rounded projections, set in a row just beneath the opening. When the interior of the case is shown, a double row of eight cells is seen to occupy it, half of the cells lying on either side of the case; each cell being lined with a stout yellowish membrane, and the end of the cells exactly corresponding with the little projections which have just been mentioned. The mother Cockroach takes a considerable time in depositing this egg-sac, and carries it about with her for several days before she finally places it in the spot where the young are to be hatched.

ANOTHER species of Cockroach is shown on Plate VII., Fig. 3. This is the FIELD COCKROACH (*Blatta germanica*), a much smaller insect than the domestic species.

Its colour is a pale yellow, sometimes taking a reddish hue, and on the large prothorax are two conspicuous longitudinal black lines, a peculiarity by which it may at once be recognised. Unlike the domestic Cockroach, which only lives in houses, the Field Cockroach lives in the open air as well as in houses, and in the former case is to be found under decaying leaves and similar situations. There is a slight difference in the colour of the insect, according to its habitation, the paler specimens being those of the open air, and the reddish hue belonging to those which live within doors.

Whether or not this species is indigenous is a mooted point, but in all probability the insect has been introduced from the Continent. Mr. Westwood remarks that he has received it

from Van Diemen's Land, and has taken it on board vessels which had just arrived from India. It is also common in Russia, where it is popularly known as the Prussian, because it is thought to have accompanied the army on their return from Germany after the Seven Years' War.

The egg-case of this species is just a quarter of an inch long and one-eighth of an inch wide, and contains thirty eggs, whereas that of the domestic species only contains sixteen, eight on each side.

The escape of the young when hatched was witnessed by Hummel, the naturalist. He took an egg-case of the Field Cockroach, put it into a bottle, and then introduced a female Cockroach. She at once seized the egg-case with her fore-legs and slit it open from end to end. Within the case lay the young larvæ attached to each other in pairs, and enveloped in a delicate membrane, which the female stripped from them so as to set them at liberty.

ALTHOUGH there has been some doubt respecting the native country of these two insects, there is none respecting certain small Cockroaches which are undoubtedly indigenous to England. They all live in the open air, and may be captured with the sweep net in long grass, heath, rushes, and similar situations. One of the smallest, *Blatta ericetorum*, is barely one-third of an inch in length, and like the rest of the out-door species is pale yellow in colour. It is found among heath.

ENGLAND possesses no example of the Ambulatoria or Raptoria, and we therefore pass at once to the Saltatoria, which may be recognised at once by the length of their hinder legs and the great development of the thighs, which are large and powerful, as is the case with nearly all leaping insects.

The first family of these insects is the Achetidæ or Crickets, in which the antennæ are very long and slender, often longer than the whole body. The wings when folded project far beyond the elytra, and form a pair of long, slender filaments. In the males there is a large spot at the base of the elytra, shining as if made of talc, and at the end of the abdomen there are two long and hairy bristles, which seem almost to serve as a second

pair of antennæ, and to warn the insect of any danger approaching from behind. The female has an ovipositor, or instrument for depositing the eggs, which in some species is as long as the body.

The best known English species is the common HOUSE CRICKET (*Acheta domestica*), which is so well known as to need but little description. Still, the reader will find that a careful examination of this insect will be especially interesting and instructive, as it affords an excellent type of the whole family. The peculiar veining, or 'neururation' as it is scientifically called, of the elytra is very well displayed, this being a very important point in the economy of the insect.

Every one is familiar with the shrill noise or 'song' produced by the Cricket. This sound is not uttered from the mouth, but is caused by the action of the elytra on each other. If the reader will examine one of these elytra taken from the male insect, he will see that there is a very strong vein or nervure, starting from a thickened spot almost one-third of the length of the elytra from the base. In the right elytron this nervure is marked underneath with a series of notches like those of a file, and this is the instrument which produces the sound. When the wings are closed, the right elytron lies over its fellow, so that its notched underside comes upon the upper part of the corresponding nervure in the left elytron. The elytra being put in rapid vibration, the notched nervure plays against its fellow, and a shrill sound is produced, strengthened by the form of the elytra, which act as sounding-boards. The action of the notched nervure is exactly the same as that of the iron 'rasp' which used to supply the place of a knocker in old houses. I may as well mention here that the name *Acheta* is Greek, and signifies 'shrill-sounding.'

The whole arrangement of the nervures, indeed, differs in the two sexes; so that a single elytron is sufficient to tell the entomologist the sex of the insect from which it was taken. In the Mole Cricket, which will presently be described, this peculiarity is of very great value, as it affords almost the only external characteristic by which the male can be distinguished from the female. In both sexes the elytra do not—as they appear to do at a casual glance—merely lie flat on the back. There is a very strong longitudinal nervure running from the

base to the tip, which divides the elytron into two parts, namely, a tolerably hard part that covers the back, and a softer part that is folded on the sides, and cannot be seen when the insect is viewed from above. On examination with a lens, this nervure is shown to be a sort of hinge, and along its inner side the elytron has a very deep fold, so that the soft part can be turned down at right angles with the hard portion.

Up to this point, the elytra are alike in both sexes, but now all resemblance ceases. The male elytron is much broader than the female, and the nervures, instead of simply running in a sort of network composed of delicate threads, are very strong, and converge towards the hard spot which has already been mentioned, merging themselves into the fine network only at the very end of the wing. On removing the right elytron, and examining it carefully, the serrations which produce the sound can be seen, if the light be properly adjusted. They are not sharp, but rounded, and their outlines are waved in this fashion { . I particularly mention the adjustment of the light, because the serrations are not easily seen ; and indeed, when I first looked for them, I had some difficulty in finding them.

The true wings of the insect are large enough to carry their owner through the air, but, like those of the cockchafer, the dor, and stag Beetle, are not sufficiently large to prevent it from knocking itself against obstacles. Gilbert White, in his 'Selborne,' Letter XLVI., mentions that the house in which he was writing was so infested with Crickets, that they became absolute pests at night, even flying into the flame of the candle and the faces of persons sitting in the room.

Of their mode of flight, he makes the following remarks :-- 'In the summer we have often observed them to fly, when it became dusk, out of the windows, and over the neighbouring roofs. This feat of activity accounts for the sudden manner in which they often leave their haunts, as it does for the method by which they come to houses where they were not known before. It is remarkable that many insects seem never to use their wings but when they have a mind to shift their quarters, and establish new colonies. When in the air, they move *volatu undoso*, in waves or curves, like woodpeckers, opening and shutting their wings at every stroke, and so are always rising or sinking.' Mr. Westwood remarks that he has

observed that Crickets not only appear suddenly in places where they had not been seen before, but disappear as suddenly from places where they had been plentiful.

In this insect, the ovipositor is long, straight, slender, and spear-shaped, being armed at the end with a sharp and enlarged tip, which looks just like the head of the spear, the shaft being represented by the body of the ovipositor. On a closer examination, this apparatus is seen to be double, and, with a little pains, the two halves may be separated from each other. Each half is then seen to be hollow, a deep groove running throughout its whole length, so that when they are placed in apposition, they form a tube along which the egg can pass.

There is, however, a further provision for the deposition of the eggs. Not only is the shaft of the ovipositor hollow, but the enlarged tip is likewise hollow, each half looking very much like the bowl of a spoon. A still closer examination reveals another fact, namely, that each of these spoon-like parts is itself double, being cleft along the centre, and capable of being opened by pressure from within. The reader will now see how beautiful and delicate is this contrivance, which enables the mother insect to introduce her egg into a very small crevice, and, while she is doing so, to hold it with a grasp—not as of the two unyielding spoons, but of four elastic springs, which can be relaxed, contracted, or entirely loosened, at the will of the insect.

Crickets are wonderfully quarrelsome animals; so quarrelsome, indeed, that if they are kept in confinement, they must be kept separately. Of a number which I placed under a glass cover, for the purpose of studying them, not one escaped unhurt. Some had their limbs torn from their bodies, some had their legs bitten completely through, all were more or less shorn of their antennæ, and several were killed outright. Whether they fight in this manner when at liberty, I cannot say; but they invariably fight when placed in confinement, males and females being alike combative, and alike suffering the penalties of warfare.

ON Plate VII. Fig. 6, is shown the FIELD CRICKET (*Acheta campestris*), an insect stronger, larger, and burlier than its

domestic relative. The sexes rather differ in colour, the male being black with a yellow patch on the base of the elytra, and the female darkish-brown. As is the case with many other insects, especially of this order, the colours change rapidly after death.

This insect lives in the open air, residing in deep burrows, which it digs in banks where the soil is loose and moderately dry. The holes are tolerably deep, and carefully avoid a straight line, so that the inhabitant cannot be seen while lying at the extremity of the burrow. It is no easy task to get the Field Cricket out of its burrow by force, for the burrow is deep, and the soil mostly so loose that when the spade is introduced into the ground, the earth all falls together, and the Cricket is lost. A much surer way of obtaining it is to push a long and flexible grass-stem into the hole, for the Field Cricket is a very irascible being, and is sure to seize the intruding object so firmly in its strong jaws that it can be drawn out of its hole before it quits its hold. In France children catch it by tying a fly to the end of a horsehair, by way of bait, and then pushing the fly towards the Cricket, by which it is at once seized. The fly, however, is quite needless, as the bare horsehair would answer just as well; the Cricket being actuated not by hunger but by anger.

As far as is known, the Field Cricket is a solitary being, the individuals of each sex living separately in their own burrow, and only meeting at night. During the daytime, although the insects will sit and sing at the mouths of their tunnels, they will not use their wings, nor even exert their powerful legs, except for slow crawling. This is a very wary insect, taking alarm at the approach of a footstep, and retreating at once into its burrow; so that although the place be one of those localities which the Field Cricket is pleased to favour with its presence, it is seldom seen though continually heard.

It has already been mentioned that the insect is a quarrelsome one. Gilbert White, who has written a charming account of it in his 'Selborne,' remarks that when he caught a number of Field Crickets, and tried to stock an old stone wall with them, the first comers took umbrage at the introduction of new settlers, and invariably attacked them with their powerful jaws. He found also, that to transplant a colony of these

insects was practically impossible, no matter how carefully the habitation was prepared for them. He tried the experiment of boring a number of deep holes in a sloping bank in his garden, and putting into them a number of Field Crickets which he took from their accustomed haunts outside the village. For a time he thought that he had succeeded in his wish, as the insects fed and sang, but they deserted their new habitation by degrees, and at last wholly abandoned it.

ANOTHER species of British Cricket is the WOOD CRICKET (*Acheta sylvestris*). This is much smaller than the preceding insect, the head and body not being quite half an inch in length, excluding the antennæ and appendages of the abdomen. It may be known by the structure of the elytra, which in the male do not reach to the end of the body, and in the female are only one-third as long as the abdomen. The male is darker and more mottled than the female. This is a very rare insect. Its home is in the New Forest, where it has been found near Lyndhurst, under dried leaves in a gravel-pit.

ON Plate VII. Fig. 5, is shown the odd-looking MOLE CRICKET (*Gryllotalpa vulgaris*), one of the largest insects inhabiting England, not only being larger than most of our insects, but stouter and more muscular. The name of Mole Cricket is a very appropriate one, for the insect is not only a Cricket, but is shaped wonderfully like the mole, and has many of the habits of that animal, as we shall presently see. There is but one genus and one species of Mole Cricket inhabiting England, and there is no possibility of mistaking the insect even in the earlier stages of existence. The tibiæ of the fore-legs are developed into a stout, broad, flat, digging apparatus, armed with sharp and strong claws, the whole limb being almost exactly like that of the mole. Two views of this extraordinary apparatus are given in Woodcut XXV., the upper surface being drawn at Fig. 9, and the under surface at Fig. *b*. The latter figure shows how the small feet and claws are tucked away under the broad, palmated tibia, so as not to be injured while the insect is employed in digging. Other portions of the anatomy of the insect are given in the same illustration, Fig. *i* representing the labium and *j* the maxilla with its palpus.

In these insects the female does not possess any ovipositor, and the only method of determining the sex without dissection is by examining the structure of the elytra, the males possessing the notched nervure, and the females being without it. The sound produced by the Mole Cricket is neither so loud nor so shrill as that of the domestic Cricket, but yet it has been produced artificially by rubbing together the elytra of a newly killed insect. The males, by the way, seem to be rarer than the females.

In consequence of this sound, it is called by several popular names, varying according to the district in which it is found. In some places, for example, it is called the CHURR-WORM, or JARR-WORM, or EVE-CHURR, while in others it is named the CROAKER. Its hard, shelly limbs and general conformation have also gained for it the name of EARTH CRAB. The colour of this insect is brown above, with a peculiarly velvety surface, and the elytra are much paler, with brown nervures.

The Mole Cricket is, as its structure shows, one of the burrowers, and it carries out, though to a greater extent, many of the habits of the Field Cricket, and prefers similar ground, so that it is necessarily a local insect. Loose sandy places are the best spots wherein to find the Mole Cricket, which can generally be captured by the simple device of pushing a flexible twig or long grass-stem into its burrow, and then digging round the twig. There is a village called Besselsleigh, a few miles from Oxford, where the Mole Cricket is tolerably plentiful, and from that place Dr. Kidd obtained the specimens which he employed when writing his admirable monograph on the insect. The soil there is loose dry sand, heaped in many places in hillocks and partly overgrown with grass, and, as it is dry, the sand falls back into the holes made by the spade. Yet, Gilbert White, in his 'Selborne,' states that the Mole Cricket haunts most moist meadows, and frequents the sides of ponds and banks of streams, performing all its functions in a swampy, wet soil.

The normal food of the Mole Cricket is of a vegetable character, and in some places where the insects are common, they do much damage to the root-crops, and even destroy garden flowers, cabbages, and grass, by devouring their roots. They will, however, eat raw meat, and on occasions become cannibals.

Dr. Kidd mentions in his monograph that he often found the hard and horny parts of various insects when dissecting the digestive apparatus; and another student of this curious insect has stated that he fed a Mole Cricket for several months on ants. Like other Crickets, the males are very quarrelsome, and fight to the death, the victor always eating his conquered adversary. The males appear to be much scarcer than the females, and in them the right elytron laps over the left, whereas in the females the reverse seems to be the case. The male may also be known by the arrangement of the nervures of the elytra and the notches of the large nervure of the right wing-case.

The eggs of the Mole Cricket are deposited under ground in a chamber about the size and shape of a hen's egg cut longitudinally. This cell is dug near the surface of the ground, so that the warmth of the sun can penetrate through the thin covering of earth, while the eggs are perfectly concealed from any ordinary foe. The eggs vary in number from one to four hundred, and are a greyish-yellow in colour. The wings being small in proportion to the size of the body, the flight of the Mole Cricket is in a succession of dips, like that of our ordinary short-winged birds.

WE now come to another family, namely, the Gryllidæ, in which are included the great bulk of the British Grasshoppers. The word *Gryllidæ* is taken from the Greek, and signifies 'a murmurer,' in allusion to the familiar sound which is produced by the males of most though not of all the species.

In this family the antennæ are long and very slender; the females are furnished with a sword-shaped ovipositor, and the wing covers of the males have a tale-like spot at their bases. Mostly both wings are furnished with these spots, but in some species there is only one spot. There is, however, one character which is common to both sexes, namely, the disposition of the wings and their covers, which, when the insect is at rest, are laid along the back and elevated in the middle like a slanting roof. These wing-covers often extend far beyond the end of the body.

Our best type of these insects is the GREAT GREEN GRASSHOPPER (*Acrida viridissima*). This handsome insect has

always been a favourite of mine, partly on account of its beauty, partly on account of its habits, and partly on account of its size, which renders it an admirable object for the entomologist who is studying that most absorbing branch of science, the comparative anatomy of insects. Moreover, the structure of the internal organism is so clearly marked, that its dissection is quite an easy task, compared with that of many insects. A figure of the Great Green Grasshopper is given in the frontispiece, a female insect being shown in the act of depositing her eggs.

When living, this insect is of the most beautiful leaf-green, but, unfortunately, this colour is very evanescent, and no sooner is the grasshopper dead than the colour begins to fade. Indeed, the hue of a living and dead specimen is as different as that of a living and dead leaf, the one being light-green and the other yellowish-brown, even becoming black in some places. I do not know any mode of preserving for any length of time the soft green hue of this beautiful insect, and regret this the more, because the creatures, which would form such beautiful objects in a cabinet, actually become unsightly, and can only be valued for scientific purposes.

This is a tree-loving insect, and is seldom found in the grass. When I was engaged in studying the internal structure of insects, I procured my specimens of the Great Green Grasshopper from a hazel hedge in a garden just on the outskirts of Oxford, the insects having for some reason or other taken an extraordinary fancy to this hedge. The young entomologist must, however, bear in mind that for the Great Green Grasshopper to be in a particular tree is one thing, and that to find it is another; for its colour harmonises so exactly with that of the leaves that no small practice is required before it can be detected. The cry of this insect is a loud one, and when it produces the shrilling sound, it clings tightly with its feet to the object on which it is standing, presses its body slightly downwards, and seems to shudder as long as the sound lasts.

The ovipositor of the female insect is very long and sword-shaped, and, on being closely examined, is found to consist of several blades, which fit against each other when the instrument is not in use, and can be separated to allow the egg to

pass to its extremity, and thus be emitted. In consequence of the shape of the ovipositor, some entomologists invented the generic name *Phasgonura*, or sword-tailed, and placed in it this and allied insects. When the young are hatched, an event which takes place in the spring, they are very tiny, but are shaped much like their parents, except that there are no wings, and in the females there is no sign of the ovipositor. This remarkable appendage does not appear until the larvæ is seven or eight weeks old, and it increases in size with every change of skin.

If the reader should possess sufficient skill and time, he should dissect a few specimens of this insect, for the purpose of studying the internal structure. Among other points, one of the most interesting is the 'gizzard.' Before it is opened, it looks very like a swelling of the digestive tube, but if it be carefully slit horizontally, and spread flat, a number of narrow, parallel bands will be seen. On placing one of these bands under the microscope, it will be seen to consist of a number of very small teeth, arranged with perfect regularity, and admirably calculated for triturating morsels of the leaves which have been cut off by the powerful jaws, and then swallowed. As for the jaws themselves, their power may be easily ascertained, for the insect is generally given to biting; and if the searcher after knowledge will put his finger in the way of this Grasshopper's jaws, he will at once be convinced both of the sharpness and strength of the jaws. Moreover, he will not feel it necessary to repeat the experiment.

THERE is a smaller species of this group, which is closely allied to the Great Green Grasshopper. This is the TREE GRASSHOPPER (*Meconema varia*), an insect which, as its name implies, is a denizen of trees rather than a dweller on the ground. It is to be found on the oak, and the best mode of obtaining it is to beat the branches and catch the falling insects in a sheet or net held beneath the boughs. Otherwise, there will be much difficulty in detecting its presence, its bright green colour being almost identical in hue with the oak leaves among which it dwells. In this insect the wing-covers of the male are without any stridulating apparatus, so that it is quite silent, and the difficulty of finding it is thereby increased.

ANOTHER of these insects is rare in England, though plentiful on the Continent. It is known by the name of WARTBITER, because its bite is supposed by the Swedish peasant to have the effect of destroying the wart. Its scientific name is *Decticus griseus*.

Very probably it really does have this effect, for there is no doubt that these unpleasant and mysterious excrescences do make their appearance and disappear without any assignable reason. Only a few days before writing this account, I overheard a dialogue between some tradesmen's boys, who, after the manner of their kind, were having a chat under cover of a hedge, instead of going about their duties. One of them made some jeering remarks to the others respecting the warts with which his hands were covered. The boy replied that he did not care for the warts, as he was going to have them charmed away next morning, and appealed to another boy, who said that his hands had been covered with warts, but that he had been to an old man who charmed them away for twopence. He held out his hands in proof of his assertion; and certainly, whatever may formerly have been the state of his hands, there was then not a wart upon them.

It is remarkable, by the way, that scarcely any two wart-charmers employ the same method. Some rub the wart with a piece of bread or oat-cake, which they bury in the earth, the wart being supposed to vanish as the bread decays. Some hold the afflicted hand between their own, and blow on it, while some stroke the spot and repeat some gibberish in an undertone. All, however, appear to agree in one point—they must be paid, and paid in coin. However small the fee, it must be a *bonâ fide* payment in cash, as otherwise the charm loses its efficacy.

The only solution of the problem that has been afforded is, of course, that the cure is wrought, not by the means employed by the charmer, but by the imagination of the person who is acted upon. But how imagination can so act upon a wart as to cause it utterly to vanish is in itself a problem which requires solution, and certainly has never received one. It is easy to see how imagination can cure an imaginary malady, but how an emotion of the mind can absorb into the system an external excrescence of the skin is not so easy of comprehension.

THE very remarkable insect which is shown in Woodcut XXV. Fig. 2, may be known by the exceedingly small size of the wings and elytra, which in the female are practically absent, and in the male are exceedingly small, not extending one-fourth along the body.

Its name is *Thamnotrizon cinereus*, and the name is a very appropriate one. It is composed of two Greek roots, the first signifying a garden, and the other, to sing, or rather, to trill, and is given to the insect on account of its habits of singing in gardens. The colour is brownish or rather grey, which in the male is marked with dark brown. The colour is altogether darker in the male than in the female. As is often the case with insects of this order, the males are comparatively rare, so that the capture of a perfect male *Thamnotrizon* may be looked upon as an event in an entomologist's day. The insects are found in gardens, or sitting among logs and brushwood, and they also frequent fir woods.

WE now pass to the true Locusts, of which we shall take one example. In these insects, the antennæ are comparatively short, and the female is without the sword-like ovipositor. On Woodcut XXV. Fig. 1, is shown the well-known MIGRATORY LOCUST (*Pachytylus migratorius*). The name *Pachytylus* is composed of two Greek words, one signifying thick and the other a knot or hump, and is given to the insect because the front of its forehead is rather projecting, and very hard and thick. Some authors give it the name of *Ædipoda*, or Swollen Leg, on account of the enormous dimensions of the thighs of the hind pair of legs.

This fine insect is very variable in point of colour, but is generally as follows:—The colour is pale brown, the elytra being simply spotted with dark brown. The wings are very large and shining, and have a slight green tinge. The legs are brown, banded alternately with black and yellow, as shown in the illustration. The thorax is covered with fine down.

This insect is happily very rare in England, and, although a few specimens make their appearance almost annually, the insect has never fairly acclimatised itself. During the summer, newspaper paragraphs are plentiful, announcing the capture of the Locust, and describing its dimensions. Many of these insects,

however, are not Locusts at all, the word Locust being applied in various parts of England to any large caterpillar or grub. Mr. E. Newman, being aware of this fact, tried to verify the 'Locust of the newspapers, and succeeded in six cases, three of which turned out to be caterpillars of the Death's-head Moth, one the same insect in its perfect state; and the other two were specimens of the common Humming-bird Hawk-moth. In all other instances I have gained no reply whatever, the writers being so confident of their entomological omniscience as to resent the idea of identification being needful.'

In hotter countries, however, the Migratory Locust is one of the most dread plagues that can pass over a land. The insects swarm in countless myriads, and, as they fly on their course, they darken the air like black clouds. Like clouds also they follow the course of the wind, for they have little power of guiding their flight, and are carried along as the wind happens to blow. Nothing but a change of wind seems to have the least effect in checking their progress, for they seem to care nothing for every obstacle that the art of man can place in their path; and even fire can do nothing to stop or divert them. Vast ranges of brushwood have been fired as soon as the Locusts were in sight, but the insects were swept whistling along by the wind; and though hundreds of thousands perished in the flames, the survivors continued their onward course, and the Locust army passed on, its numbers scarcely perceptibly thinned.

Even in Europe the ravages of the Locust have been terrible; and in the South of France rewards have been offered for many years for the destruction of these insects, a certain sum being paid per kilogramme of the eggs, and double the amount for the perfect insects. But in Asia and Africa, their armies almost exceed belief. One column of these insects measured no less than five hundred miles in length, and was so wide that, as it passed along, it darkened the earth to such an extent that large buildings could scarcely be seen at a distance of less than two hundred yards. This swarm occurred in India.

There is a powerful account given by Chenier, and quoted by Southey in his 'Thalaba,' of the effects produced by a swarm of Locusts in Morocco. 'In 1778, the empire of Morocco

was ravaged by these insects. In the summer of that year such clouds of Locusts came from the south that they darkened the air and devoured a part of the harvest. Their offspring committed still greater mischief. Locusts appeared and bred anew in the following year, so that in the spring the ground was wholly covered, and they crawled one over the other in search of their subsistence.

‘The whole country was eaten up: the very bark of the fig, pomegranate, and orange-tree—bitter, hard, and corrosive as it was—could not escape the voracity of these insects. The lands, ravaged throughout all the western provinces, produced no harvest; and the Moors, being obliged to live on their stores, began to feel a dearth. Their cattle died with hunger; nor could any be preserved but those which were in the neighbourhood of mountains or in marshy grounds, where the regrowth of pasturage is more rapid.

‘In 1780, the distress was still further increased. The dry winter had checked the products of the earth, and given birth to a new generation of Locusts, who devoured whatever had escaped from the inclemency of the season. The husbandman did not even reap what he had sowed, and found himself destitute of food, cattle, or seed corn. In this time of extreme wretchedness, the poor felt all the horrors of famine. They were seen wandering over the country to dig roots, and, perhaps, abridged their days by digging into the entrails of the earth in search of the crude means by which they might be preserved.

‘Vast numbers perished of indigestible food and want. I have beheld country people in the roads, and in the streets, who had died of hunger, and who were thrown across asses to be taken and buried. The husband, with the consent of his wife, would take her into another province, there to bestow her in marriage, as if she were his sister, and afterwards come and reclaim her when his wants were not so great. I have seen women and children run after camels, and rake their dung, to seek for some undigested grain of barley, which, if they found, they devoured with avidity.’

The writer also mentions the mode in which the young Locusts were destroyed in one province. A vast trench was dug, more than three miles in length, and extending from the

sea to a river. The miniature Locusts, which were unable to fly, their wings not being as yet developed, were driven into the ditch, whence they were unable to escape. In this way the district was cleared of the Locusts; but their numbers were so vast that, on the third day after they were driven into the ditch, their putrefying bodies infected the air, so that no one could approach the trench. The reader will doubtless have noticed how similar is this account to the many Scriptural references to the Locust and its numbers. In Southern Africa, the young Locusts are called Voet-gangers, or Foot-goers, and are even more dreaded by the agriculturist than the mature insects.

There is certainly one redeeming point about the Locusts. They eat the leaves, the flowers, the grass-blades, and the very twigs; but, then, they can be eaten themselves. I never had the opportunity of tasting a Locust, but I know several travellers who have done so; and they all agree in saying that the insect, though dry, is rather palatable than otherwise, and that, when the provisions run short, the Locusts form an acceptable addition to the commissariat. I think, however, that the dryness which is mentioned is caused by the rough-and-ready style of cooking which is adopted by travellers under such circumstances, and that if the insects were better cooked they would be better flavoured.

I am led to this belief by the Nineveh sculptures in the British Museum. One of them represents a train of servants carrying various meats to a great feast. Among them there are several men, who are bearing long sticks, on which are tied Locusts, just as cherries are tied on a stick or onions on a string. It is evident that in this case the Locust is not looked upon merely as a succedaneum for better food, but as being a delicacy which was worthy of a place at a public feast, and was borne aloft by bearded attendants.

Although this is the species which is most common in these Locust armies, several other species equally deserve the name of Migratory, and are equally destructive to the herbage.

I cannot leave the Orthoptera without mentioning that the arrangement of its members is very unsatisfactory, and, in spite of the exertions of several able entomologists, much

remains to be done. No common arrangement has as yet been accepted, and the consequence is that scarcely any two books, or two cabinets, employ the same system, to the very great confusion of the beginner in entomology. Still, the broad distinctions which have been given in the preceding pages are simple and intelligible, and, by their means, the various Orthopteran insects of England can be grouped without much difficulty.

THYSANOPTERA.

THYSANOPTERA.

CHAPTER I.

THE little creatures which will be briefly described in these pages are now ascertained to belong to a separate order, which has been named THYSANOPTERA, on account of the curious structure of their wings. This name is derived from two Greek words—one signifying a tassel, and the other a wing—and has been given to the insects of this order because their wings are furnished on the edges with a fringe of long hairs. These wings are long, narrow, and are not folded, but lie flat along the back, and slightly crossed over each other. There is no distinction between wings and elytra, and in most of the species the hairy fringe is more than twice as wide as the wing which it surrounds. In some species the wings are long, but in some they are short, while in others they are practically absent, being only represented by the undeveloped rudiments.

One of these insects, *Phlaothrips coriacea*, is shown in Woodcut XXVII. Fig. 1, and is a good example of the order. As may be seen by the line on its left side, it is a very tiny insect, about the twelfth or fourteenth of an inch in length, and yet it is larger than many of the same curious group. Owing to their small size, it is not very easy to make out their structure, but the reader should try, with the aid of the microscope, to examine the head and the parts of the mouth, which are very remarkable; and, though formed of mandibles and palpi, are united into a sort of conical sucker, which lies under the breast when the insect is still.

There is no difficulty in procuring specimens, as the insects are exceedingly plentiful—much too plentiful indeed—and

may be seen in swarms upon flowers and various plants, especially infesting those of the greenhouse, where they become an absolute pest, particularly if the gardener be careless about his plants. They collect in great numbers on the underside of the leaves, the chief part of the damage being done by the larvæ, which mark the leaves with little decayed patches. Stone fruits of various kinds are also much damaged by them, the little creatures making their way into the ripe fruit at the base of the stalk, and then crawling in—much as do the ants—between the stone and the soft substance of the fruit.

There are many species of these insects, which popularly go under the collective name of Thrips, but the distinctions are too many and minute for any but a purely scientific work. The exact position of the order is still a mooted point among entomologists, as these insects resemble the Orthoptera and Hemiptera in their transformations, while the structure of the mouth is quite unlike that of either of these orders. Van der Hoeven seems scarcely to think that the Thysanoptera constitute a separate order, and considers them as an appendix to the Orthoptera.

NEUROPTERA.



NEUROPTERA.

CHAPTER I.

THE important order of insects which comes next on our list is a very remarkable one. The name Neuroptera is formed from two Greek words, the one signifying a nerve, and the other a wing, and has been given to these insects because the transparent wings are traversed by a vast quantity of nervures, which divide the wings into a greater number of spaces or 'cells' than is the case with any other order of insects. Both pairs of wings are of equal size and of equal solidity. The larva has always six legs, and the pupa is sometimes quiescent and sometimes active.

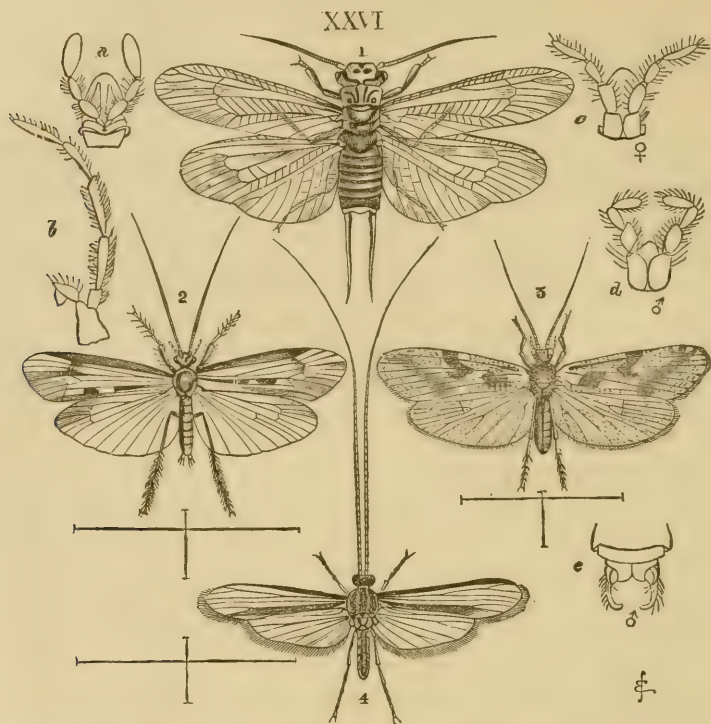
The Neuropterous insects fall naturally into several groups, the characteristics of which are so strongly marked that they are well known by popular names, such as Stone-flies, Dragon-flies, Lace-wing-flies, and the like. There are not many species inhabiting England, but the insects are mostly plentiful, and are sufficiently large and handsome to constitute much of the beauty of our country scenes.

We will begin with the Perlidæ, or Stone-flies, as they are popularly called. These insects are very dear to the angler, inasmuch as they supply some of his best and most certain baits, whether the real insect be used, or only the imitation called the 'artificial fly.' They are the more valuable from being dull and sluggish in their habits, so that they can be easily captured as they sit upon the trunks, stones, and other objects near the water's edge.

One of these insects, *Perla marginata*, is shown in Woodcut XXVI. Fig. 1, and may be at once recognised. The colour of this insect is pale yellowish brown, and the nervures

of the upper wings are peculiarly large and bold. All the Perlidæ have the second pair of wings, very large, and capable of being folded. The body is rather flattened, and equally wide throughout its length. The tarsi have three joints.

These insects are aquatic in their habits. During their larval and pupal stages they live in the water, and after they



1. *Perla marginata*. 2. *Limnephilus bicolor*. 3. *Phryganea minor*. 4. *Leptocerus ochraceus*. a. *Limnephilus*, labium. b. *Limnephilus*, maxilla. c. Labium of ditto, female. d. Labium, male. e. Anal appendages or clasper, male.

have attained their perfect condition, they love to remain near the water in which they were reared, and seldom travel to any distance from the familiar banks. The mother insect imitates in one respect the female Cockroach, for she carries the eggs about with her, attached to the end of the abdomen, for some time before they are laid. They are not, however, enclosed in a hard case or pouch, like those of the Cockroach, but are merely united together in a small black globular bundle,

the effect of which against the light-brown grey body and wings is very remarkable, as the insect flutters heavily from spot to spot. The membranous envelope within which the eggs are contained is exceedingly delicate, so that it shows both the shape and colour of the eggs which it encloses. The egg-cluster of *Perla marginata* is about as large as a swan-shot, and nearly as black. It is rather more barrel-shaped than globular, and, on being examined with a lens, is seen to be composed of several hundred eggs, agglutinated together in a sort of semi-order, as if the eggs had been deposited in strings, and the strings wound at random into a ball.

These eggs are deposited in the water, and when hatched, the young larvæ manage to crawl under stones and similar sheltered localities. They prefer running to still waters, and the more rapid parts of the stream to those which are comparatively still. In the swift river Dove these creatures are very plentiful, and I used to capture almost any number of them in the spring time, the rippling, eddying stream exactly suiting them. Near my present house is a very small pond, through which a stream of water continually runs. It is marvellously rich in insect life, and I have captured in it a variety of aquatic insects in all stages, which utterly astonish those who are not initiated in the wealth of entomology. Yet, though I have industriously fished every inch of this pond, I have never found the larva of the Stone-fly. Larvæ of May-flies, Dragon-flies, Caddis-flies, Dyticus, Acilius, Gyrinus, Noto-esta, Gnats, and other aquatic creatures, I take in plenty, but not one single Stone-fly larva have I found, though I have sedulously examined both the inlet and outlet of the stream which runs through the pond and keeps it supplied with water.

In the present genus, the abdomen is very stout, and has two long slender appendages at its tip. The wings of the male are very short in proportion, and altogether he is quite an inferior being to his stately mate. There are several species of this group in England, some of which are known to anglers by various popular names. The name of Stone-fly is, however, given indiscriminately to at least four species. One is that which has already been mentioned; another is scientifically known as *Perla grandis*; a third is *Perla cephalotes*, which, as its name implies, has a very large head; and a fourth, perhaps

the best known, is *Perla bicaudata*. Then, the familiar 'Yellow Sally' of anglers is *Chloroperla viridis*, and the equally familiar 'Willow-fly' belongs to the genus *Nemoura*.

As is the case with many other aquatic insects, the pupæ of the Stone-flies crawl out of the water when they are about to assume their perfect state, so that when they come to expand their wings an ample space may be gained for this important, and often perilous, task. The details of this process will be explained in connexion with the various species of Neuropterous insects.

All the Perlidæ have a very moth-like aspect, especially on the wing, and, owing to the invariable sombreness of their hues, and their great similitude in shape, there is considerable difficulty in distinguishing between the various species. With many species this difficulty is still more increased by the difference in size between the sexes, the males being scarcely one-third as large as the females, and having wings very short in proportion to the length of their bodies.

Now we come to another family, the Ephemeridæ, better known by the popular name of May-flies. In many respects these are very curious insects, and not the least remarkable point about them is that in the perfect state they have no mouth. The parts of the mouth are certainly there, but in a rudimentary condition, and entirely incapable of receiving food, so that during the time of its existence as a perfect insect, the *Ephemera* never eats, neither does it require to eat.

The wings are very unequal in size, the lower pair being very small, and in some species reduced to mere rudiments. In consequence of this formation of the wings, Dr. Leach considered that the May-flies ought to be formed into a separate order, to which he gave the name of Anisoptera, or unequal-winged insects. The end of the body is furnished with either two or three long and slender filaments; and by these three characters—the mouth, the wings, and the tail—the May-flies may be at once distinguished from all other insects. The best known species, *Ephemera vulgata*, or COMMON MAY-FLY, is shown on Plate VIII. Fig. 1.

The transformations of the May-flies are very remarkable, and in some respects almost unique. In its larval condition,



PLATE VIII.

DRAGON-FLIES, MAY-FLIES, AND CADDIS.

1. *Ephemera vulgata*.
2. *Ephemera*, larva.
3. *Libellula depressa*.
- 3a. *Libellula* emerging from pupa-case.
4. *Libellula*, larva.
5. *Calopteryx virgo*.
6. *Agrion minium*.
7. *Phryganea grandis*.
8. *Phryganea*, larva cases, or Caddis.

PLANTS :—

Flowering Rush (*Butomus umbellatus*). In Centre.

Mare's-tail (*Hippuris vulgaris*). On Right.

Water Bistort (*Polygonum amphibium*). On Left.



the May-fly is an inhabitant of the water, and in form much resembles the perfect insect, except that it has no wings. This species lives in the muddy banks of rivers and ponds, and burrows for itself certain ingenious tunnels. These burrows are double, running horizontally into the mud, and having two outlets. In fact, they are shaped much like the letter C, so that the larva can crawl in and out of its hole with perfect ease. Its food appears to consist of the decaying vegetable matter of which fresh-water mud is largely composed.

In consequence of its hidden dwelling, this larva is not often seen even by those who are in the habit of fishing for aquatic insects. I have found two plans to be successful in its capture. The first is, to detach a large piece of mud, take it carefully from its place, and then examine it under water. The second plan is, to push a stick into the mud and work it about so as to drive the larvæ out of their burrows, and then to move the net rapidly to and fro in the clouded water. By this plan several other aquatic insects may be captured, which are much too wary to allow a net to come near them as long as they can see it. The muddy water, however, reduces them to a temporary state of blindness, and they are then taken without difficulty. Some of the smaller species do not burrow, but live at liberty in the water. In these species the surface of the body is harder than in those which burrow.

One of these larvæ is shown in Plate VIII. Fig. 2, in order to give the reader an idea of its shape. In its larval condition this creature is furnished with two rather long and many-jointed antennæ, which, in the perfect insect, shrink into an almost rudimentary form. Along each side of the body runs a series of thin plates in which the branchiæ or gills spread themselves. These are said to assist in locomotion, but I have not seen them used for that purpose; the undulation of the body and the employment of the legs seeming to be sufficient for that purpose. At the end of the abdomen are three fringed appendages or setæ, and it is a rather curious fact that even in those species which have only two setæ in the perfect state, the larva possesses three of those appendages. The pupa differs little in shape from the larva, except that the wings show themselves boldly in the form of projections in the back of the thorax.

After passing some two years in the preliminary stages, the *Ephemera* prepares for its change into the perfect form. The pupa leaves the water, and almost as soon as it emerges into the open air, the pupal skin splits, and enables the insect to crawl from within its former envelope. The wings are soon stretched to their utmost, and the insect then flies slowly to some tree or post where it affixes itself, and appears to rest after its exertions.

Another change, however, awaits the insect, for this state is only preliminary, and is scientifically called by the name of 'pseudimago,' or false insect. After it has waited for some little time—depending, as far as I can see, on the warmth and dryness of the atmosphere—the skin again splits, and through the aperture the insect emerges, leaving the abandoned skin clinging to the tree, and looking exactly like the living insect. The wings now assume a lighter and more delicate aspect, the filaments at the end of the body increase to nearly twice their former length, and the May-fly launches into the air to take its part in that evening dance with which we are all so familiar, the insects rising and falling almost in the same place for several hours together. Should the reader be an angler, he will recognise in the female pseudimago the 'Green Drake,' and in the perfect insect the 'Grey Drake.' The angler only cares for the female insects, because the fish prefer them, laden as they are with eggs, to the males, which have little in them but air.

The May-fly has not much time in which to enjoy its new phase of existence. As has already been mentioned, it has no mouth, and as it cannot eat, is evidently incapable of any lengthened term of life. It has in fact but one business, namely, to seek a mate, and provide a new generation in place of that which is now passing away. The May-fly seldom lives more than a few hours, and in its natural condition is supposed never to exceed the limits of a single day. The name *Ephemera*, which is formed from two Greek words signifying an existence of a day, alludes to this shortness of life, and was given to the insect as long ago as the time of Aristotle. Isolated specimens have certainly lived longer than this brief term, for they have been known to live more than a week in captivity. Had they, however, been at liberty, it is most probable, if not certain, that their lives would have been as short as is mostly the case with the May-flies.

In Kirby and Spence's well-known work, there is an account of a still more strange prolongation of life. There are certain flies whose larvæ feed on aphides, which live in their three stages about six weeks. One of them had been caught when half-grown, and, having been once or twice fed, was forgotten for three months, when it was found to be alive. It actually lived for a whole year without a particle of food, and, as is well remarked, 'it had existed in the larva state more than eight times as long as it would have lived in all its states, if it had regularly undergone its metamorphoses, which is as extraordinary a prolongation of life as if a man were to live 560 years.'

Sometimes the May-flies are wonderfully numerous, the air being filled with their swarms as they flutter up and down in their strange flight, and the trees and banks covered with the shed pellicles of the first-winged stage. Even in England I have known the May-flies to be in such swarms that the very trout could not be taken with the hook, so gorged were they with the May-flies that fell by thousands into the water. In some parts of Europe, however, the numbers of these insects are so vast, that their bodies are collected into heaps and used for manuring the fields.

THE next family is a very conspicuous one, and there is no likelihood of mistaking one of them for any other kind of insect. Scientifically these insects are termed Libellulidæ, and they are familiarly known as Dragon-flies or Horse-stingers, the latter name being given them from an absurd notion that they sting horses. It is curious to notice how widely and deeply this idea has impressed itself upon the general mass of country people, and to see how terrified they are at the very idea of touching a Dragon-fly. I suppose that the convulsive jerkings of the long-bodied Dragon-flies when captured have given rise to this opinion. With regard to the name of Dragon-flies, it is a very appropriate one, as we shall presently see.

In these insects the body is always long, and in most cases nearly cylindrical, though in some it is rather wide and flattened. The wings are very large, powerful, translucent, strongly veined, and of equal size; and the meshes, or 'reticulations,' are so close as to divide the wing into a very great number of cells.

The head is adorned with two enormous eyes, or rather eye-masses, and, during the life of the insect, the light plays in and through these eyes in a most beautiful but quite indescribable manner. Unfortunately, this play of colour and light fades together with the life, and, when the insect is dry, it vanishes altogether. Beside the compound eyes, there are three 'ocelli,' or simple eyes, placed usually in a row on the front of the head. The antennæ are very short and small, and have never more than eight joints. The mouth is very curiously formed, the mandibles and the maxillæ being hidden behind two large flat lips, which move up and down while the insect is eating, so that at first sight the Dragon-fly really looks as if its mouth worked vertically and not laterally.

During its preliminary stages the Dragon-fly lives in the water, and the larva is one of the most curious and interesting beings which our waters produce. These larvæ are so wonderful, in fact, and possess so many points of interest, that I scarcely know which to take first. The chief points of interest lie, however, in the head and the tail, and we will give to the former the place of honour.

At first sight the head does not appear to differ very much from that of other insects, but on closer examination a very singular development of the mouth is shown. If the creature be turned on its back, a horny plate will be seen, which covers the whole of the under side of the head and descends as far as the bases of the middle pair of legs. With a pin it is easy to raise this plate, which then shows itself to be composed of several portions and furnished with a hinge, by means of which it can be doubled upon itself. The upper part, which covers the face, is much widened, and is furnished with two jaw-like appendages, which can be opened or closed at will, and are finely toothed at their lower edges.

This remarkable apparatus is a development of the lower lip, and is called the mask, because, when closed, it covers the lower part of the head. The object of the mask is to catch prey, and a very effective apparatus it is. When an unfortunate insect comes near, the Dragon-fly larva suddenly unfolds its mask, darts it out to its full length, and seizes the insect in the jaws. The mask is then closed again, and, when folded, the jaws of the mask come exactly upon those of the

mouth, so that the prey can be eaten without trouble. In Plate VIII. Fig. 4, the end of the still folded mask is seen, the jaws being opened preparatory to the darting forward of the mask. The shape and details of this structure vary somewhat in the different species.

The larva is a voracious creature, and will eat almost any aquatic insect which it can master, and has even been known to catch and eat small fishes. In its own turn, however, it falls a victim to the more powerful inhabitants of the water, being attacked and eaten by the *Dyticus* and even by the *Acilius*. Two specimens of *Acilius* which I kept in an aquarium managed to eat, in little more than a fortnight, three out of four Dragon-fly larvæ which were in the same vessel; and in the waters where the creatures live I have often found the dead and partly-eaten bodies of Dragon-fly larvæ, the destroyer having evidently been the *Dyticus*.

We will now proceed to the other end of the creature, and examine its tail. When taken out of the water, the tail appears to end in a sharp, horny point; but, when it is replaced in water, the pointed tail opens and shows that it is composed of five sharp appendages, three being much larger than the others. When they are opened, a tube is discovered passing into the body of the larva. All the five spikes are jointed together at their bases, so that if one be drawn aside the other four immediately spread themselves apart. The aperture which lies between them is just large enough to allow an ordinary pin to pass easily through it.

Within the abdomen is the respiratory apparatus, which extracts the oxygen from the water, and, when that gas has been exhausted, the water is expelled and a fresh supply taken in through the same aperture. If the larva be placed in a shallow vessel and watched carefully, the process of respiration can be easily observed. The five pointed projections are kept about half open, and the water is ejected in gentle and tolerably regular pulsations as long as the creature is undisturbed. Should it, however, be alarmed, it suddenly expels the water with such violence that it drives itself forward with great speed, the principle being exactly the same as that which causes the flight of a rocket.

If the bottom of the vessel in which the larva is kept be

dusted with fine sand, the force of the expelled water can be at once measured by the displacement of the sand. If the vessel be a deep one, no such proof of the propelling power can be seen, and the creature darts through the water as if impelled by some magic power. The reader may perhaps remember that a 'direct action' movement has lately been applied to steamboats, the principle having been avowedly borrowed from this very creature.

There is very little change in form or habits between the larva and the pupa. Towards the end of the larval existence, a sort of longitudinal hump makes its appearance on the upper part of the thorax, and, when the last larval skin is thrown off, this hump is seen to consist of the future wings, which are at present thick, narrow and small, their tips only reaching about one quarter of the length of the abdomen. The mask retains its place and office, but the head is much larger and broader, and the splendid eyes of the perfect insect begin to shine under their covering.

It is quite as voracious in the pupal as in the larval stage of existence. One of my own specimens has just seized with its mask the larva of a Whirlwig Beetle which had been unlucky enough to come within reach. The whole proceeding was very much like that of the toad when catching insects. The mask flashed out so rapidly that its movements were scarcely visible, and in a moment the unfortunate larva had been grasped by the middle and held against the cruel jaws. So rapid, indeed, was the movement, that it looked very much as if the larva had intentionally darted into its destroyer's mouth.

One of these insects made a rather absurd mistake. It saw a detached leg of a *Dyticus* which was floating on the surface, shot itself immediately under it, and seized the leg in passing. It soon discovered its error; and, after trying in vain to eat the hard-shelled limb, jerked it away as if in anger. I have noticed that in seizing its prey the Dragon-fly larva prefers, like the shark, to get below it, and to make an upward stroke with its armed mask.

A still stronger proof of voracity was also given. I had taken a larva of the *Acilius*, one of the Water Beetles, which is closely allied to the *Dyticus* described on page 59. It is

itself a voracious and formidable creature, being furnished with two enormous curved jaws, and in form almost exactly resembling the larva of the *Dyticus* shown on Plate III. Fig. 4. Thinking that the larva would be very well able to take care of itself, I put it into the basin, intending next morning to observe through the microscope the fringed apparatus at the end of the body. But, at a very early hour next morning, the larva had vanished. I knew that it was physically incapable of crawling out of the vessel, and at last, after a strict search, I found one of its large mandibles lying at the bottom of the basin, the only vestige that the voracious Dragon-fly larva had left of its victim.

Since that enormous meal the larva has changed into a pupa, and is just as restless and voracious, and has completed its course of destruction by killing and eating its companion, the contents of whose body it has completely scooped out.

Although neither in the larval nor pupal state does it possess the vivid colours with which the perfect insect is adorned, it is yet possessed of a certain beauty. The colour of the body is pale brown, but the legs are as translucent as if made of horn and banded at regular intervals with small dark-brown stripes. Along the sides, each segment of the body is furnished with two sharp and projecting spikes, which point towards the tail. In consequence of this structure, the creature is a difficult one to hold, wriggling itself like a snake when held in the fingers, and gradually working its way through them. The best way of examining these curious beings is to take one of them and place it in a shallow saucer, with just enough water to cover it. The under surface can be observed in the same vessel; for, if the larva be laid on its back, it gives a few struggles and then seems to acquiesce in its position, lying perfectly still, and allowing the lens to be placed close to its body without appearing to be in the least alarmed.

The particular larva that has been described is that of *Eshna grandis*, one of our largest Dragon-flies, but the description will suit almost any species, their general form and habits being very much alike.

When the pupa has nearly completed its time it ceases to feed, and the respiration seems difficult and laboured. An

irrepressible instinct then drives it to leave the water in which it has so long lived, and, seizing the stem of a reed or other aquatic plant, it crawls upwards until it is a foot or two above the surface; claspings the reed firmly with its feet, it sways itself backwards and forwards until the pupal skin splits along the shoulders and the wings and body of the perfect insect show themselves beneath it.

The respiration is now changed. Formerly, as has been described, that function was performed by means of a gill-like apparatus within the body, but now the insect begins to breathe atmospheric air by means of spiracles. It rests for a time, as if to accustom itself to so radical a change, and then recommences its struggles. By degrees it draws itself entirely from the pupal envelope, which is left still clinging to the plant up which it had crawled. In spots where Dragon-flies abound, these shed skins can often be found, clinging as firmly to the plant as if still tenanted by the insect. The metamorphosis, though complete in one sense, is not yet finished; for the wings are still thick, short, and scarcely larger than in the pupal state. Presently the insect begins to take a series of deep inspirations, quivering the wings the while; and, as it does so, they rapidly enlarge, fold after fold shakes itself out as the air is driven through the vessels which permeate them, and at last they are spread in all their shining beauty. Yet a while the insect waits until the wings have gained their needful strength, and then it darts off into the air to begin its new life.

As in its former stages, the Dragon-fly is terribly predaceous, and, contrary to the ways of most insects, eating seems to be the chief object in life. From early morning to night-fall the Dragon-fly is perpetually hunting and devouring prey, and in nowise particular respecting the nature of its food nor the way in which it is obtained. For example, if a Dragon-fly be caught uninjured, and held by its wings, it will eat almost any amount of insects that may be supplied to it. Nor does it confine itself to insects, for it will devour spiders, centipedes, millipedes, fresh-water shrimps, and similar creatures; and, as soon as it is released, it will start off again on a hawking expedition, apparently as hungry as if it had had nothing to eat for a whole day.

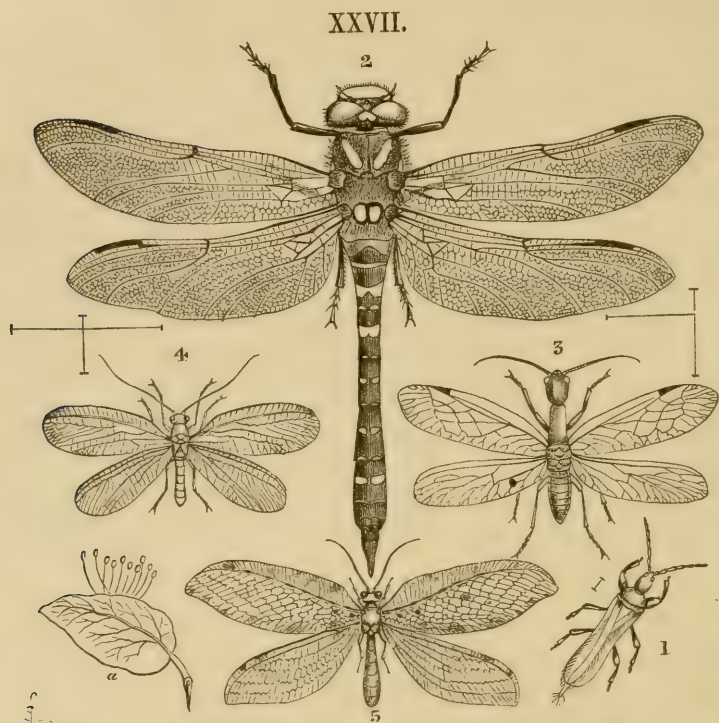
There is a peculiarity in the flight of the Dragon-fly—at all events in some species—which assists it greatly in chasing prey. It has the power of suddenly reversing the stroke of its wings, so that it can stop itself in full career, and can even fly backwards with some speed. This power is specially useful when the Dragon-fly is engaged in chasing an insect among obstacles, and, when it has darted into a narrow passage in which there is not sufficient space for it to turn, it can back itself out again without much difficulty.

It is a pity that the lovely colours with which most of these insects are decorated should be so fleeting, but it is a sad fact that there are scarcely any insects in which the colours last for so short a time after death. The only plan for preserving them that seems at all feasible is that which was employed by the late Mr. Waterton, namely, taking the insect to pieces, removing the interior, painting the inside of the empty shell with the requisite colours, and then putting the pieces together again. Still, even this tedious and laborious plan does not answer with the comparatively solid thorax, and, as many species have stripes of bright scarlet, yellow, blue or green on the thorax, the process is evidently an imperfect one. The species which is shown in the Plate, *Libellula depressa*, keeps its colour better than any which I know, but then its hues are never at any time brilliant. Some of them retain sufficient colour to show what their hues have been, but in all cases the brilliancy of the various tints passes away and cannot be renewed.

WE will now take in detail one or two of the most prominent species as examples of this beautiful family. They are divided into two large groups, called Libellulides and Agrionides. The insects of these groups may easily be distinguished by the shape of the head, which in the Libellulides is rounded, and in the Agrionides is more cylindrical and set cross-wise to the body, something like that of the hammer-headed shark. So strongly is this mode of structure defined in some of the species, that without their wings they bear no little resemblance to croquet-mallets. We will take two examples of each group.

On Woodcut XXVII. Fig. 2 is represented one of our finest

Dragon-flies, known to entomologists as *Cordulegaster annulatus*. In this genus the ocelli are set in a row, the eyes toward each other above; the lower or anal angles of the lever wings are boldly angulated, and the abdomen is club-shaped. Reference is made to this peculiarity in the generic name *Cordulegaster*, which is composed of two Greek words, the former signifying a club, and the other the belly. The insect



1. *Phlaeothrips coriacea*. 2. *Cordulegaster annulatus*. 3. *Raphidia ophiopsis*. 4. *Chrysopa vulgaris*. 5. *Osmylus chrysops*. a. Eggs of *Chrysopa*.

attains a very great size, being sometimes even larger than the illustration, and is very handsome in point of colour, the whole body and thorax being marked with bold bands and stripes of rich golden-yellow. A specimen in my collection has retained the yellow marks of the thorax in a wonderfully perfect manner, but those of the abdomen have almost wholly perished.

Our next species is that which is represented on Plate VIII. Fig. 3. Its name is *Libellula depressa*, and it is generally accepted as the typical species of the family. In the insects of this genus the ocelli are set in a triangle, the body is mostly broad and flattened, and the anal angle of the lower wings is rounded. The present species is not so handsome in point of colour as the preceding, but is yet adorned with a delicate blueish tint, looking in life very much as if the body had been first painted blue, and then dusted very finely with pearl-powder. The upper part of the thorax is yellow. The dark spots at the bases of both pairs of wings are deep rich chestnut brown.

This is a wonderfully active insect, and, probably on account of its short body, it has a way of darting boldly among the branches of trees and shrubs in order to chase its prey. When thus engaged, and with prey in sight, it becomes so much engaged in pursuit that it can be easily captured in the net, though at other times it is very wary, and will seldom permit the net to approach within striking distance. The larva of this insect is shown at Fig. 4 at the bottom of the page, and at Fig. 3a is represented the escape of the perfect insect from the pupal skin.

NEXT come the Agrionides, two of which are shown on the same page. At Fig. 5 is shown the beautiful DEMOISELLE DRAGON-FLY (*Calopteryx virgo*). In the insects of this genus there is no 'stigma,' or dark spot on the outer edge of the wings. This species is remarkable for the very great difference in colour between the sexes. The females, one of which is here figured, are totally green, both wings and body, whereas the males are deep-blue, with black patches on the wings. In some places these insects absolutely swarm, and about Oxford they may be found in the greatest profusion, hovering over the many streams and ditches which intersect the country, and giving almost a tropical beauty to the scene, as they flit about with the sunshine glittering on their richly-tinted bodies and wings.

An example of the typical genus *Agrion minium* is given on Plate VIII. Fig. 6. There is no difficulty in distinguishing the members of this genus from other Dragon-flies. The

'stigma' is not only existent on both pairs of wings, but it is boldly rhomboidal in shape, the angles sloping inwards.

It does not look very conspicuous, and this is exactly its character. The Agrions are so slender and delicate that on a bright summer day they scarcely look like insects, but appear more like streaks of coloured light wafted here and there without any settled purpose. The eye soon learns to distinguish their forms, but there is really something so delightfully fairy-like about them as they come and go, apparently by magic, that the disillusioning is really matter of regret. They are of various colours, among which red and blue predominate. The present species is vermilion-red, from which it derives its specific title of *minium*, and on the thorax are streaks of yellow as well as of red. The red colour forms a conspicuous patch on the end of each joint of the abdomen.

WITH very great regret I must leave these beautiful and interesting insects, and proceed to another family, which are not at all beautiful, and, though interesting in their way, cannot be compared in that respect to the Dragon-flies. These are the Raphidiidæ, a family of insects formed after a very curious fashion, the prothorax being lengthened into a prolonged neck, and the head being rather broad and much flattened. The females are furnished with a long and slightly curved ovipositor, consisting of two blades. The wings are of moderate dimensions, and nearly equal in point of size, and they are very strongly veined.

Owing to the long neck-like prothorax, the insects are able to twist their heads about in various directions, from which habit they have received the popular name of SNAKE-FLIES. They are predaceous in their habits, and may mostly be seen on or near the banks of ponds and small streams, where they can find their prey. They are not at all handsome in point of colour, their hues being confined to greyish-brown, mottled with darker brown or black. One of the largest British species, *Rhaphidia ophiopsis*, is shown on Woodcut XXVII.

The larva of this insect is predaceous, feeding upon small insects. It is long and narrow, and even in the larval form shows the elongated prothorax which is so characteristic of the perfect insect. Mr. Westwood, who had this creature alive,

states that 'it creeps but slowly, but gives to its body violent jerking motions in every direction, somewhat like those of a serpent.' In the pupal state, the wings are pressed to the body in such a way that they cover the hind pair of legs. These larvæ may be found under the bark of trees.

The name *Raphidia* is formed from a Greek word signifying a needle, and is given to these insects on account of the great elongation of the prothorax. The specific name *ophiopsis* is also from the Greek, and signifies 'snake-eyed.' The females of this group have a long and slightly curved ovipositor, formed of two plates.

ON Woodcut XXVII. Fig. 4 is shown one of our most beautiful British insects. This is the LACEWING-FLY (*Chrysopa vulgaris*), a representative of the family Hemerobiidæ. The wings of this family are large and broad, and pressed against the sides of the body when at rest; the antennæ are long, delicate, and many jointed; and the head is small, with two very prominent and rounded eyes. The tarsi have five joints. The form of this insect is very accurately given, though it is impossible with the simple black and white of a wood engraving to do justice to the wonderful and delicate beauty of the insect, about which is not one particle either of black or white. Its body, head, and thorax are leaf-green, and its wings are wide, thin, gauzy, and glossed with changing hues of green and pink, according to the angle at which the light falls on them.

The chief beauty of the insect lies, however, in its eyes, which, without the aid of a magnifying glass, look like two tiny beads of burnished gold, and have earned for the insect the popular name of GOLDEN-EYE, of which the Greek word *Chrysopa* is but a translation. But if the insect be placed under the microscope, and a brilliant light be directed on the eyes, a wonderful change takes place. They are very convex in form, and the hexagonal facets are marked with extreme boldness, considering the small size of the organ. They are so clearly defined, indeed, that even with a common pocket magnifier of low power they can be easily distinguished.

Were the eye to be simple brown or even black it would be a beautiful object, in consequence of these hexagonal lenses, but

over the whole surface of the compound eye plays a brilliant combination of colour. Every separate hexagon looks like a framework of burnished gold, changing with the shifting light into various hues of rich green and carmine. In fact, the whole eye looks very much like a hemispherical brooch, entirely covered with emeralds and rubies.

It is rather hard on the insect to expose it to this strong light, which is needed to bring out its beauties, for it is a lover of darkness, and only comes out after sunset, when it may be observed fluttering with apparently aimless flight in the air. But it is impossible to see the full splendour of this magnificent object without exposing the insect to some inconvenience. A dead specimen is useless, for the colour departs alike from body and eye. As to the pale-green of the body, it is the most fugitive colour that an insect can possess, while the more gorgeous hues of the eye vanish soon after the life departs, and very little is left of their once magnificent beauty. Would that some method could be discovered of preserving the too fugitive tints of this lovely insect. There is a specimen now before me which has only been dead some forty-eight hours, and already the tender green of its body is fading, and the fiery splendour of its eyes is quenched. Lovely as is the insect to the eye, it can offend another sense most grievously, for it possesses a peculiarly evil odour, which attaches itself strongly to the finger that crushes it, and cannot be removed without many washings.

The Lacewing-fly is allied to the Ant-lions, of which we have no genuine representative in England. When in the larval state it is very predaceous, as is betokened by its large and curved mandibles. It feeds mostly on aphides, of which it devours vast numbers, draining them of their juices, and then covering itself with the emptied bodies of its victims, so as to render itself scarcely distinguishable from the lichens among which it mostly lives. The neck of the larva is very flexible, so that it can dart its head in any direction in order to seize its prey. It can eat two large aphides in one minute, and is so voracious that if two Lacewing larvæ meet each other they are sure to fight, and the conqueror is equally sure to eat the vanquished combatant. These larvæ are quick in their growth, and do not require much more than a fortnight before they

pass into the pupal state, provided only that they can find an abundant supply of aphides on which to feed. When full fed the larva spins a cocoon, in which it passes into the pupal and perfect stages. Like the Ant-lion, to which it is allied, it packs itself up in a wonderfully small compass, for the cocoon is only as large as a sweet pea, and very much of the same shape.

The eggs of the Lacewing-fly are quite as remarkable as the cocoon. They are generally deposited on leaves, but, instead of being laid directly on the leaf, every egg is fixed to the end of a slender footstalk about half an inch in length. This footstalk is formed from a viscous matter secreted by the female, and is delicately white and translucent. Mr. A. G. Butler, of the British Museum, told me that he has kept Lacewing-flies, and often seen them lay their eggs. The end of the abdomen is first pressed against the leaf, and a tiny drop of the viscous matter deposited. The abdomen is then raised quickly, so as to draw out a thread, which becomes stiff and hard almost as soon as it comes into contact with the air. Then the insect pauses a little, and rapidly places an egg on the end of the thread, fixing it there with another tiny drop of the secretion. The eggs are always laid in groups, one of which is shown on Woodcut XXVII. Fig. *a*. Some specimens in my own collection are laid along a lilac twig, and in all of them the remains of the viscous drops are apparent in the form of a partly conical footstalk, much resembling in shape and translucency the foot and stem of a wine-glass. The eggs themselves are pure white, and, when viewed through a microscope, have something of a papery aspect. They bear a curious resemblance to the capsules of certain mosses, and indeed have been described and figured in books as specimens of British moss.

ANOTHER member of the same family is shown on Woodcut XXVII. Fig. 5. This is called scientifically *Osmylus chrysops*, but I am not aware whether it possesses any popular name. This genus can at once be distinguished from *Chrysopa* by looking at the front of the head, in which there are three ocelli or simple eyes, set in a triangle on the forehead, whereas there are no ocelli in *Chrysopa*.

This is the largest British example of the family, and,

though not so eminently beautiful as the preceding insect, is yet a pretty creature. The wings are translucent, with a glossy, iridescent sheen, very much resembling the surface of the varnished skeleton leaves on which the Chinese artists paint such exquisite little pictures. The spots with which they are variegated are pale brown. The insect is tolerably common, and at Oxford is plentiful on the branches of oaks. The pupa is to be found in the moist earth of ditch banks.

BEFORE passing to the next order, it is necessary to say a few words respecting the Scorpion-fly, or *Panorpidæ*, which form a very marked family of their own.

They derive their popular name from the remarkable conformation of the abdomen, the joints of which are almost exactly like those of a Scorpion, and in the typical insect, the common SCORPION-FLY (*Panorpa communis*), are terminated, in the male, by a pair of small forceps, sufficiently strong to make themselves felt on the skin of the human hand. When the insect is handled, it brandishes its abdomen about in so menacing a fashion that I have often seen its captors hastily loosen their hold, thinking that it really must possess the power of mischief which it so well imitates. The pincers are formed by a development of the eighth segment of the abdomen. The insect is a very common one, and can be taken by beating hedges and underwood.

There are only two British genera of *Panorpidæ*—one to which the common Scorpion-fly belongs, and which contains five species; and the other, named *Boreus*, of which a single species is known, *Boreus hyemalis*.

This is a most singular being. It is a very tiny insect, and, with its long legs and peculiarly shaped body, bears a great resemblance to a larval grasshopper. The form of the head, however, is enough to show that it really belongs to the *Panorpidæ*. In the male, the wings are very small, useless for flight, and project from the back something like Mr. Punch's hump. In the female, the wings are entirely undeveloped, and the body is terminated by a long ovipositor, very curiously constructed. There is no direct passage or 'oviduct,' so that the eggs must first be deposited, and then picked up between

the blades of the ovipositor, which open vertically, and not laterally, like those of the Orthoptera.

This is not a common insect, and, as if to add to its eccentricity, it chooses the middle of winter for its appearance in the perfect state. Hence its scientific name of *Boreus hyemalis*—the former word signifying the north wind, and the other wintry. The males are rarer than the females.

TRICHOPTERA.

TRICHOPTERA.

CHAPTER I.

THERE has been much discussion respecting the insects which now come before our notice, some entomologists thinking that they ought to belong to the Neuroptera, but the majority deciding that they really form an order of their own, which has been called by the name of TRICHOPTERA, on account of the structure of the wings. They are popularly known as CADDIS-FLIES, sometimes abbreviated into 'Cads,' Straw-worms, Pipers, Cockspurs, Cod-baits, Grannums, &c.; and, both in the perfect and larval conditions, are very familiar to anglers.

In this order the wings are four in number, the first pair generally covered profusely with hair, and the second pair large, and folded when at rest. The tibiae are furnished with long spurs, in some species running to a wonderful length in the second and third pair of legs. The mouth, like that of the May-fly, is quite undeveloped, so that when the insects have attained their perfect state they can take no nourishment.

The larva is aquatic, and furnished with six feet. It lives in cases more or less cylindrical, constructed by itself from various materials, such as leaves, sticks, bits of grass, stones, sand, shells, and even the opercula of water-snails. I have taken within the distance of a few yards several cases thus constructed; and I once took a case, the principal portion of which was a chrysalis of a moth—I believe the common Hop-dog—which had fallen into the water. The larva retains its position by means of two hooked appendages at the end of the tail.

Having now glanced at the leading characteristics of the

order, we will proceed to a more detailed examination, and take for our type the GREAT CADDIS-FLY (*Phryganea grandis*), which is drawn on Plate VIII. Fig. 7, and can be easily recognised from the figure.

In this genus the spurs of the tibiæ are moderately developed, and the wings are very heavy. The palpi of the male have only four joints, whereas those of the female have five. The wings are very thickly covered with hair, so thickly indeed that, under the microscope, they look as if they were clothed with fur. The hairs are comparatively pale and small on the membrane of the wing, but dark, stout, and bristle-like upon the nervures. The body is similarly furred, and even the antennæ are so densely haired that the divisions of the joints are quite hidden. It is on account of this profuse growth of hair that the name Trichoptera, or Hairy-wings, has been given to this order of insect.

There is no particular beauty of colour to be found in any of the Trichoptera, the hues being in all the species nothing more than various shades of brown, the difference in colour being produced in most species by the greater or less admixture of yellow.

The habits of these insects are very interesting. Unlike the Lacewing-fly, they are quick on foot, and can run with a curious celerity, being even able to make their way upon the surface of the water, over which they scuttle quickly, using much exertion, and the edges of their closed lower wings leaving a long track behind them. They can even travel under water. The females are in the habit of crawling down the stems of aquatic plants nearly a foot below the surface, in order to deposit their eggs. If the plant to which they are clinging be smartly tapped, they will at once leave it and swim under water to another submerged plant. This habit of theirs often causes them to fall victims to various fish, which towards midsummer find an unfailing supply of such food.

As in the case with the Stone-flies, which have already been described, the female Caddis-fly collects her eggs and carries them about at the extremity of the body. The egg-cluster is double, green in colour, and the eggs are held together by a gelatinous substance, in which they are enveloped. By means

of this gelatinous secretion, which has the capacity of resisting water, the egg-cluster is affixed to the stem of some subaquatic plant, and there left to be hatched in due time. The duties of the mother Caddis-fly being then over, she perishes, either by natural decay, or by means of some fish, which doubtlessly thinks itself deceived in having been induced to eat a mere shell of an insect, as is the Caddis after she has deposited her eggs.

When the little larvæ emerge from the egg, they set to work in forming for themselves the remarkable habitations in which they pass the whole of their larval and pupal existence. Being long, soft-bodied creatures, with only the head and neck defended by a horny covering, they would fall victims to various predacious inhabitants of the water, if they possessed not the power of forming for themselves some sort of protection. Following the general rule under such circumstances, the protection in question assumes the shape of a case more or less cylindrical, and is capable of being enlarged in proportion to the growth of the inhabitant.

As has been already mentioned, these habitations are made of various materials, and are all more or less cylindrical as far as regards their interior, though in many instances their exterior departs as far as possible from that shape.

For example, one or two of the species always select dead leaves, which they fit together, face to face, so that scarcely anyone on seeing them would imagine that between the leaves was the tubular residence of a Caddis-worm. Sometimes, as in *Phryganea rhombica*, short pieces of grass stems are used, which are cut into tolerably equal lengths, and fixed across each other so as to leave a hollow in their centre. Sometimes, as in *Phryganea lunaris*, the pieces of grass are much longer, and laid side by side. Some species, such, for example, as *Phryganea fusca*, use the shells of various aquatic molluses, which they fasten together without the slightest reference to the feelings of the inhabitants, some of which may be seen vainly trying to progress in one direction, while the Caddis-worm is crawling in another. Examples of these two last-mentioned forms may be seen in Plate VIII. Fig. 8. Some species, such as *Sericostoma multiguttatum*, employ particles of sand, tiny stones, and similar materials, forming them into a conical case with a slight curve, very much resembling in shape an

ordinary cow's horn. In fact, the materials, and consequently the forms, of these remarkable habitations are so various that it is impossible to do more than briefly describe the leading varieties.

All the habitations which have just been mentioned are movable, and are carried about by the larva, just as the Hermit Crab carries its shell-house with it. There are, however, Caddis-cases which are fixed to stones, and which cannot be moved. Such, for example, are the habitations of *Hydropsyche senex* and *Hydropsyche maculicornis*, the former of which makes a house that is shaped very much like a leech when at rest, and is fixed by the whole of its under side to the stone. The habitation of the latter, however, is quite worm-like in shape, and often considerably curved.

In consequence of the differing form of these habitations, it follows that there must be a corresponding difference in the structure of the inhabitants. All the Caddis larvæ hold themselves within their cases by means of claspers at the end of the body, and very firmly they hold, as anyone can tell who has ejected them from their habitations. But these claspers are modified in their construction according to the kind of habitation. Those larvæ which dwell in movable tubes never leave them, but crawl at liberty from one spot to another in search of food. They have really wonderful powers of adhesion, and can climb smooth and hard surfaces with the greatest ease. There are now before me some larvæ of *Sericostoma* which have crawled up the sides of a glass vessel, one or two of them having even raised themselves partially above the surface of the water. In all these species the claspers are short, so that they only permit the head and leg-bearing segments of the body to protrude beyond the mouth of the tube. But in the species which live in fixed tubes the claspers are placed at the ends of two long footstalks, so that the larva can thrust itself far out of its tube, and thus obtain a wide range wherein to procure food. Some of these creatures feed upon small aquatic larvæ, but the food of the greater part seems to be mostly vegetable, though all the species appear to vary their diet occasionally with animal substances.

Whatever may be the species, and whatever the material of their cases, the various portions of which the habitations are

composed are always fastened very strongly together with a glutinous cement which has the property of hardening under water. If one of these cases be pulled asunder, and the severed surfaces submitted to the microscope, the cement will be seen to have been torn into short, white threads, very much like the 'byssus' of certain bivalves, such as the common mussel of our sea-coasts.

When the larva is full-fed, and is about to pass into the quiescent and feeble state of pupa, it fortifies its habitation by spinning across each end a network of a very peculiar construction. There are many species of Caddis-flies, and I do not think that in any two species the network is exactly the same. In all it is very stiff and strong, but there is invariably a distinct pattern on which the meshes are arranged, and which can only be made out by the use of a tolerably powerful magnifier.

After remaining within the fortified case for a time, which varies according to the species, the pupa makes its way out of the case, and, when fairly in the open air, shakes off its pupal skin and assumes its perfect form. There is some slight difference as to the mode of performing this feat, the larger species acting like the Dragon-flies, and crawling up the stems of aquatic plants, while the smaller are content to make use of their cast skins as rafts, on which they can stand while they shake out their newly-acquired wings to dry in the air.

HAVING now traced the life of the Caddis-fly from the egg to the perfect insect, and taken one species as the type, we will briefly examine one or two other species as examples of this remarkable, though small order.

The first of these is the LESSER CADDIS-FLY (*Phryganea minor*), a figure of which is given on Woodcut XXVI. Fig. 3. This, though smaller than the Great Caddis-fly, is really a handsomer insect, being much more variegated than its larger relative. The colour of the body is yellowish-brown, and the back of the head and thorax are covered with yellowish down. The upper wings are densely clothed with hair, and are pale brown, variegated with a rich dark brown, which near the end of the wing forms a band stretching nearly across it, in a slightly diagonal direction. The lower wings are shining

and iridescent, and the antennæ are pale brown barred with the same dark hue as that which ornaments the upper wings.

ON Woodcut XXVI. Fig. 2, is shown an insect which has the popular name of the ELEGANT GRANNUM (*Limnephilus elegans*). In the genus to which this insect belongs, the body is rounded, and the wings are narrow and rather squared at the ends. The maxilla and its palpus is shown at Fig. *b*, and the labium with its palpi at Fig. *a*. There are nearly fifty species of this large genus, all of which have a very moth-like appearance, specially when seen on the wing or when 'set' in a cabinet.

When alive, the body of this species has a slight yellowish tinge, the upper part being blackish, and the segments being edged with whitish grey. The wings are very shining, and the upper pair are pale brown with dark nervures, and one or two dark spots and streaks. The lower pair are pearly in hue, and rather iridescent when the light falls on them in different angles.

ON the same Woodcut, Fig. 4, is shown another of these curious insects, named scientifically *Leptocerus ochraceus*. In the insects belonging to this genus, the tibiæ of the hindmost pair of legs have two spurs, and the antennæ are exceedingly long and slender. The name *Leptocerus* alludes to this latter characteristic. It is formed from the Greek words, signifying 'slender-horned.' In the illustration, the antennæ are of the right length, but are too thick, especially at the base. These organs are in reality almost as slender as hairs, and even when the insect has been set and dried, the long and delicate antennæ wave about with every breath of air, and give to the dead insect an air as if it were again alive. When the wings are closed, and the insect is sitting on a leaf, it bears a curiously close resemblance to the Long-horn moths which will be described on a future page. There are rather more than thirty species of this genus.

HYMENOPTERA.

HYMENOPTERA.

CHAPTER I.

SAW-FLIES.

WE now come to one of the largest and most important orders of insects, namely the HYMENOPTERA, an order which comprises the insects known popularly as Saw-flies, Gall-flies, Ichneumon-flies, Ants, Wasps, and Bees. Those insects which are known as White Ants or Termites, belong, however, to a different order, namely the Neuroptera.

The characteristics of this order are well defined, and there is no difficulty in ascertaining, almost at a glance, whether an insect belongs to the Hymenoptera or not. The wings are four in number, the second pair being smaller than the first pair, and having fewer veins. They are without hair and membranous, as indeed is shown by the name Hymenoptera, which is formed from two Greek words, the one signifying a membrane, and the other a wing. When at rest, the wings are separate, but when the insect flies, both pairs are hitched together by a series of little hooks which run along the upper edge of the lower pair, so that, for the time, the insect flies with two wings instead of four. These hooks are beautifully constructed, and should be examined with a microscope. They will be found well developed in the common wasps and bees. On Woodcut XXVIII. the wings of a hornet are shown on the left side as they appear when separated, and on the right as they are when united by the hooks. The head is armed with horny jaws, and between them lies a fleshy tongue enclosed in the maxillæ, which form a sort of sheath to it. The abdomen of the female is furnished with a horny ovipositor formed of

several pieces, which in many instances is modified into a poison-bearing sting. The pupa is quiescent, and the larva is both quiescent and without feet, except in one group, that of the Saw-flies.

In all books that treat scientifically of the Hymenoptera, a vast amount of technical language will be found. Many of the words, such as those which express the general divisions of the body, the parts of the mouth, the anatomy of the limbs, &c., are the same as those which we have already learned when treating of Beetles. But, in this order of insects, very great stress is laid upon sundry portions of organisation which are but little considered in the Coleoptera, and therefore I have given a chart-drawing of a hornet, similar to that of the Stag-beetle on page 9. I strongly advise the young entomologist to take a hornet, or even a wasp, and make out all the parts by means of this diagram, and he will find that if he colours the diagram he will fix it more firmly in his memory. The colouring should be taken from the insect itself.

According to Mr. Westwood's system, the Hymenoptera are divided into two great sections, namely, the Terebrantia, or Boreers, and the Aculeata, or Sting-bearers. We will proceed with these sections in order. The first subsection is called Serrifera, or Saw-bearers, in which the abdomen is attached to the thorax by the whole of its diameter, and the larvæ feed upon vegetable substances, and have a well-developed mouth furnished with mandibles. This subsection includes the whole of the Saw-flies and Gall-flies.

WE will begin with the insects which are so well known as Saw-flies, and are scientifically termed Tenthredinidæ. This word is a very old one, being used by Aristotle in his 'History of Animals' to signify some kind of bee or wasp. It is formed from a Greek word signifying to gnaw or nibble. The names *Andrena*, *Pemphredon*, &c., are derived from the same source. In these insects, the wings are large, with many 'complete' cells, i.e. cells closed on every side by nervures, and having a large stigma or spot. The abdomen has no footstalk, and is furnished in the females with the extraordinary apparatus which has gained for the group of Hymenoptera the popular and appropriate name of Saw-flies

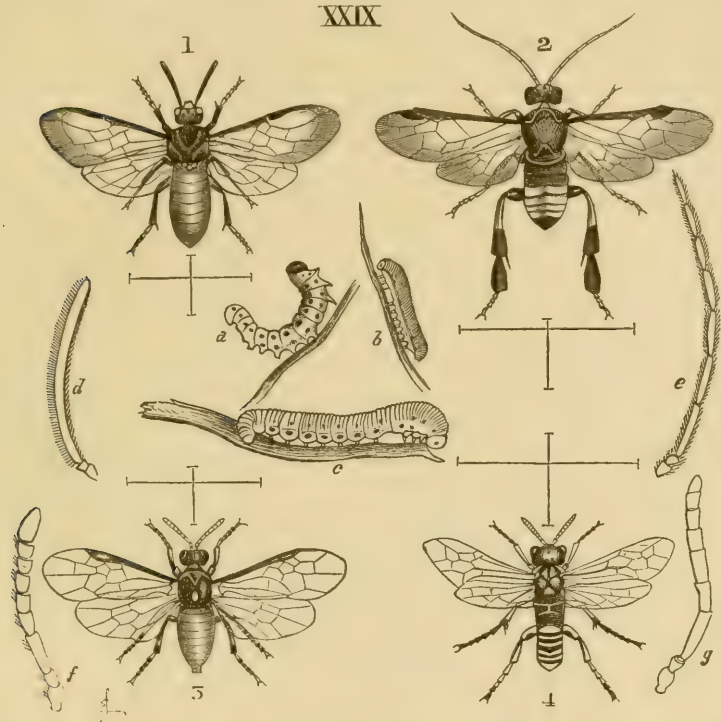
At the extremity of the abdomen and on its under surface are placed two flat horny plates set side by side. These are the saws, and, like the well-known 'tenon-saw' of carpenters, have one edge toothed, and the other strengthened by a flat thick plate. On examination with a tolerably powerful lens, the teeth are seen to be most elaborately constructed. Instead of being mere simple teeth, like those of a saw, each tooth is formed of a cone set in a footstalk, the cone being deeply cut into eight or ten deep grooves, having a sharp edge between each. This structure is wonderfully adapted to prevent the saw from clogging with the green wood in which it has to work, and might with advantage be copied by our tool-makers. The toothing of the saw differs in the various species of Saw-fly, but the form which has been described is found in some of the insects with which our list commences.

The strengthened backs of these saws are received into grooves or sheaths in which they slide backwards and forwards, and they are so contrived that while one saw is being thrust forward, the other is being drawn back. There is not the least difficulty in getting these beautiful instruments under the microscope. They are of course best seen in the recent specimen, but even after the insect has been long dead and dry, the saw can be detached with a little careful manipulation. The object of the saw, which is indeed a modification of the ovipositor, is to prepare a resting-place for the eggs. By alternately working the saws, a groove is rapidly cut in a twig, or a leaf rib, and an egg is then passed between the saws and deposited in the groove, where it is fixed by a small drop of liquid secreted by the insect. The number of grooves and of the eggs deposited in them varies according to the different species of Saw-fly. Even if the observer should fail to see a Saw-fly in the act of depositing her eggs, he can always see the grooves and the eggs in them, by carefully examining the leaves and young twigs of various trees. The common currant is often much damaged by Saw-flies, and on a single bush there will be scarcely a leaf in which the grooves cut by the Saw-fly cannot be found. These grooves are made on the under side of the leaf, partly because the nervures are thicker, and partly because the eggs are sheltered from the rain.

In process of time the eggs are hatched, and from them are

produced larvæ which very much resemble those of moths. They can, however, be at once distinguished from them by the fact that they have more legs and 'pro-legs,' or false feet, than the true caterpillars. No caterpillar has more than sixteen of these members, whereas the larva of the Saw-fly has from eighteen to twenty-two. One of these larvæ, that

XXIX



1 *Hylotoma rosæ*. 2. *Croesus septentrionalis*. 3. *Athalia spinarum*. 4. *Allantus scrophularia*. a. *Croesus* larva. b. *Athalia* larva. c. *Allantus* larva. d. *Hylotoma*, antenna. e. *Croesus*, antenna. f. *Athalia*, antenna. g. *Allantus*, antenna.

of *Cimbex lutea*, is shown on Plate IX. Fig. 3, and others are seen on Woodcut XXIX. Figs. a b and c.

HAVING thus rapidly gone through the chief characteristics of the Saw-flies, we will examine them somewhat more in detail.

The first insect on our list is *Cimbex lutea*, which is shown on Plate IX. Fig. 1, of its natural size, and a more detailed

drawing is given on Woodcut XXX. Fig. 1, in order to show the characteristic details of the genus. In this genus the club of the antennæ consist of two joints soldered together, and the rest of the organ is formed of five joints. The spurs are rather short and blunt, and in the male insect the tarsi of the fore-legs are spined beneath. There are about eight British species of *Cimbex*. The colour of the present species is, as may be inferred from its name, yellow, and all inexperienced observers might easily mistake the insect for a wasp, especially when flying.

The larva is shown both in Plate IX. Fig. 3, and in Woodcut XXX. Fig. *a*, the latter figure being given in order to show its structure. It has in all twenty-two feet and four legs, and the body is covered with very small tubercles. Just over the spiracles, or breathing holes, there are some apertures, through which the larva can spirt a greenish fluid to some little distance. It ejects the fluid when it is alarmed, but the supply is limited, and each successive discharge is weaker than its predecessor. Like most Saw-fly larvæ its colour is greenish grey. Contrary to the usual practice among insects, this larva prefers the upper side of the leaf, where it may be found partly coiled up, with its tail in the centre. It feeds on various trees, such as the elder, the birch, and the beech, but Mr. F. Smith tells me that he has generally found it on the willow.

In process of time, the larva attains its full growth, and then sets to work at spinning a cocoon in which it can undergo its transformations. The cocoon is wonderfully tough and leathery in texture, brown in colour, and is rather fluffy on the outside. It is affixed to some twig of the tree on which the larva fed, and in winter time is very conspicuous owing to the absence of leaves. One of these dwellings is shown on Plate IX. Fig. 2. If one of these cocoons be carefully opened before the insect has made its final change, the pupa can be seen lying quietly in its cell like a child in a cradle, and apparently as helpless. It remains for a considerable time in the cocoon, and finally makes its escape at one end of its dwelling.

On Plate IX. Fig. 5, is seen a very fine insect, known scientifically as *Trichiosoma lucorum*. The name of this genus is formed from two Greek words, signifying Hairy-body,



PLATE IX.

SAW-FLIES, GALL-FLIES, AND SIREX.

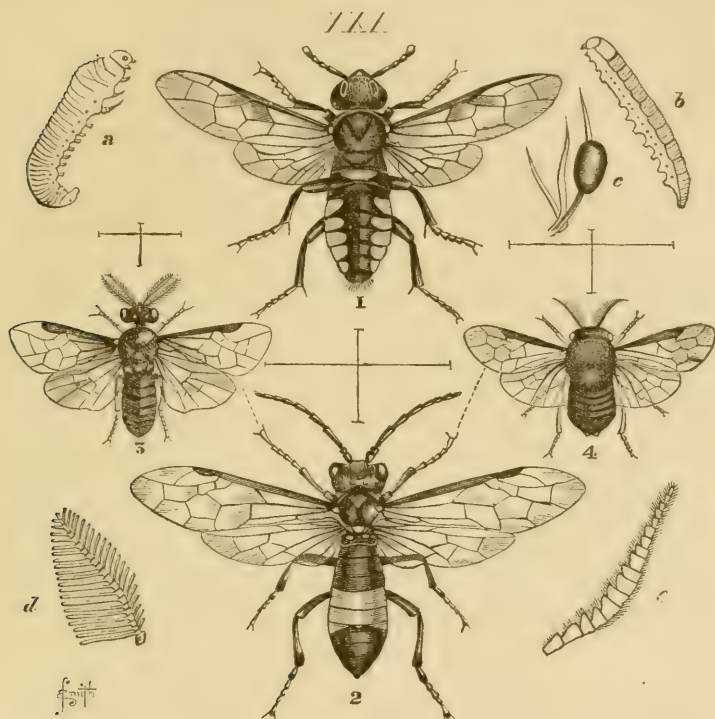
1. *Cimbex lutea*.
2. *Cimbex*, cocoon.
3. *Cimbex*, larva.
4. *Lyda hortensis*.
5. *Trichiosoma lucorum*.
6. *Cynips Kollari*.
7. *Sirex juvencus* (Male).

PLANTS:—

Oak. Fir, and Hawthorn.



and is given to the insects because their bodies are thickly covered with hair, instead of being nearly naked like those of the preceding genus. The whole appearance of the body is so bee-like that most persons who see the insect imagine that it belongs to the bees and not to the Saw-flies. It can, however,



1. *Cimbex lutea*. 2. *Tenthredo zonatus*. 3. *Cryptus pallipes*. 4. *Lophyrus pini*.
 a. *Cimbex* larva. b. *Lophyrus* larva. c. *Lophyrus*, cocoon. d. Do. antenna, male.
 e. Do. antenna, female.

be distinguished by the shape of the antennæ, which are terminated by round knobs composed of three joints fused together. The rest of the organ is composed of five joints. The colour of the insect is dark brown, and the wings are darkish, with a smoky streak along their lower edges.

The insect is common upon whitethorn, and may be seen in all these stages. The larva, like that of the last-mentioned Saw-fly, prefers the upper surface of leaves, and coils itself up in a

similar fashion. The cocoons are not easily seen as long as the leaves are on the trees, but if a whitethorn hedge be carefully examined in the winter, the cocoons of the *Trichiosoma* will probably be found in tolerable plenty. The twig on which they are fixed should be cut off, and the cocoons placed in a box with a cover of wire gauze in order to await the appearance of the perfect insect, which takes place in the spring. At that time of year, the fly is not at all uncommon, and may be captured with the net as it flits about the hedges, seeking for convenient spots wherein to deposit its eggs.

I well remember taking some of these Saw-flies when beginning my entomological career, and, not having access to books, being entirely puzzled by them. At first, I naturally took them for bees, but could not understand how the knobbed antennæ could belong to a bee. Then, the creatures, though they were females, had no sting, and as I was not then aware that Saw-flies of such magnitude existed in this country, I was naturally puzzled. Yet, the very fact of this bewilderment served to fix the creatures so firmly in my mind that, even at this distance of time, I could draw from memory the first *Trichiosoma* that I ever caught. The saws of this insect are well worthy of examination, as they possess the cone-tipped teeth which have been described on page 298.

The larvæ can be taken at the end of summer, when they are nearly full-fed, and as they are very large and conspicuous, there is little difficulty in obtaining them.

ON Woodcut XXIX. Fig. 1, is seen a figure of the ROSE SAW-FLY, called scientifically *Hylotoma rosæ*. The name *Hylotoma* is formed from two Greek words, signifying 'Wood-cutter,' and is therefore a very appropriate one.

In this genus the marginal cell is drawn out to a point, and the shape of the antennæ differs in the two sexes. Those of the male are nearly straight and hairy, while those of the female are smooth and tend to a club towards the ends. The antenna of the male is shown on Woodcut XXIX. Fig. *d*.

This is a much smaller insect than those which have been described, as may be seen by the cross-mark immediately below it. The colour of the thorax is black, and that of the abdomen bright yellow, with an orange tinge during life. The upper

edge of the wing is black, and the tips are darker than the centre. The larva of this insect may be known by having the sides of each segment of the abdomen lengthened into a sort of flap, which covers the pro-legs. This larva may be found on the leaves of the rose, with its body bent upwards, and sometimes even assuming a double curve.

THE most superficial observer must notice that the insect which is represented on Woodcut XXX. Fig. 3, is a very curious one. It belongs to the same group of Saw-flies as the last-mentioned insects.

The male is remarkable for the structure of the antennæ, which, as may be seen from the illustration, are not only feathered, but double, the divisions taking place at the scape or first joint. In the female the antenna is single and not feathered. The head and thorax of this curious insect are black, and its abdomen yellow. Its scientific name is *Schizocerus pallipes*. Both names are appropriate. The first is formed from the Greek words signifying 'Divided horn,' and the second, which signifies Pale-footed, is given to the insect in consequence of the pale colour of its legs. The insect was first taken in Coombe Wood, by Mr. J. King, and has since been captured sparingly. It still remains, however, a very rare insect.

HERE must be mentioned the terrible TURNIP-FLY OR NIGGER (*Athalia spinarum*) which is shown on Woodcut XXIX. Fig. 3. In this genus the insects have either nine or ten joints in the antennæ, the third joint being a long one and the ends widening into an ill-defined club, as may be seen at Fig. *f*. In the wings there are two marginal and four submarginal cells. The reader will now see the importance of these cells in the arrangement of the Hymenoptera. Many persons seem to think that neither number, shape, nor size is of the least consequence, and that, in drawing such an insect, the artist may put in any number of cells and shape them as he likes. The entomologist, however, knows better, and though he cannot be expected to carry in his mind the exact number and shape of the cells, he can always tell at a glance whether the wings have been carefully sketched from nature, or carelessly drawn from imagination.

The head of the insect is black, and so are the sides and base of the thorax, while the rest of the body is bright yellow. The wings are translucent, and along the upper edge is a streak of black. The larva of this insect is grey-black, and is therefore popularly called the Nigger. It is always to be found in some localities where turnips are grown, but in certain years it appears in vast numbers, and is one of the worst plagues that a farmer can fear. Somewhere about July, the parent insects appear by thousands, and make their way to the turnip-fields, where they lay their eggs, using for the purpose the saw-like ovipositor which has already been mentioned. Mr. E. Newman has given great attention to these small though terrible insects, and his description of them in the 'Letters of Rusticus' is so graphic that I cannot do better than transfer it to these pages:—

'These flies do not taste the turnips, but only come to them on family business: they deposit their eggs on the under side of the leaf, gluing them on the cuticle. In a very few days they were hatched; from the eggs had emerged the little caterpillars. On August 9, these little creatures swarmed on every leaf. I walked over field after field, and found them all in the same state. On Mr. Moline's farm, at Old Pond, three men were hoeing the turnips on a Saturday; I showed them the enemy, and told them that the turnips would be thin enough by Monday, without any hoeing; however, they were farmer's men, and "knowed better." On Sunday I could not get out so far as a turnip-field. On Monday I was again in the field at Old Pond, and the turnips were not. Since my last visit they had been swept from the face of the earth. The land was everywhere as bare as on the day it had been sowed. There was no speck of green for the eye to rest on. It was a wild and universal desolation; and the black, crawling vermin that had caused the ruin were clustered in bunches on the ground, or lingering about the skeletons of the turnip-leaves. No plague of Egypt could have been more effective; the mischief was complete. Some fields received the blast a few days later than others, but all had it; not one escaped, unless the crop were swedes, and it is remarkable that these were untouched.

'I will now give a somewhat more particular history of this

blight. The egg is of an oblong form and pale colour, and is so firmly glued to the cuticle of the leaf that I have never been able to get one off without breaking it; but when the egg is removed it leaves, or rather discloses, a wound in the cuticle of the leaf, and I have little doubt that this wound is made by the parent fly, in order that the egg itself may receive nourishment from the juices of the plant. This is perhaps a little hypothetical, but there is a fact which seems to require such an explanation, for the egg positively grows, while still to all appearance an egg. At the end of four days its bulk is nearly doubled, and by the ninth day, when the grub comes out, it is actually three times as large as when deposited.

‘Directly’ the young Nigger is let out of the egg-shell, he begins eating away in right earnest. The first onslaught is generally made as near as possible to the spot where he was born, but after a day or two the edges of the leaf seem to be most favoured by his attentions, and here the whole family may be seen working with a will, their heads at the work of demolition, and their tails cocked up in the air. In an incredibly short space of time the green of the leaf is gone, and nothing is visible but the naked skeletons of veins, which the Niggers do not choose to consume. The colour of the grub is a dull lead colour, with a rather rough or wrinkly skin, but without hairs; and down each side, from stem to stern, is a paler line. Its length, when full grown, is between half and three-quarters of an inch. It has no less than twenty legs, six of which are placed in three pairs, very near the head. These six are long, hard, horny, and sharp-pointed, and with them the grub holds fast the edge of the leaf while he goes on devouring it; the other fourteen legs are arranged in seven pairs along the body, and are soft and fleshy without any horny substance, and quite without sharp points. These legs are used when the grub is crawling; but while he is eating, and the tail, indeed the greater part of the body, is, as I have already said, cocked up in the air, they are quite unemployed. Sometimes, and especially when offended or in danger, the Nigger-grub coils himself up in a ring, holding the leaf very slightly by the first pair of legs, that pair next the head; and when touched in this state, falls directly to the ground, and there lies as though

dead; indeed, if not in a ring before, he almost always rolls himself into one when touched.

‘When the Nigger has reached his full size—a period depending on the temperature of the weather and the supply of food, but averaging twenty days—he burrows in the earth, and there makes a little oval house, just big enough for his body, which has all at once become shorter and thicker: he then plasters the walls of this place with a sort of sticky varnish or glue, which he discharges at this time only; he keeps on discharging and spreading this glue till he is quite surrounded with a strong, tough, and hard cocoon, the particles of earth being mixed with the glue, and the whole forming an admirable and perfect defence against wet or the attacks of insects. The period of his stay in this cocoon varies according to circumstances: if the weather is hot, it sometimes happens that the grub becomes a mummy-like chrysalis in ten days, and a perfect fly, and again on the wing, in five more; but the greater part of the brood remain unchanged all through the autumn, winter, and spring. I have turned up the cocoons, and found the grub little altered even in May.

‘Soon after this the change to a chrysalis must take place, and the change to a fly occurs, in average seasons, about the middle of July; when this is accomplished, it moistens one end of its cocoon, so as to make it easy to come out, and then it climbs up through the earth and takes wing. But the plough and harrow, the operations of which are sure to follow the eating off of the turnip-crop, often turn up and expose the cocoons, so that, instead of being an inch or two below the surface, they are laid at the top. The system of crop rotation, however, serves to remove the fly of the Nigger from the food best fitted for its progeny; and it often happens that the flies come to maturity in a field of ripening grain, the ears of which they mount, and, spreading their wings, float off in myriads to the nearest turnip-field.

‘I find a hundred recipes for the destruction of these Niggers, all of which are moonshine except one, and this, for a wonder, is rational. It is this: buy an immense number of ducks, and turn them into your turnips, and they will devour the niggers by millions, and in a few days become as fat as butter. Thus two birds are killed with one stone—the ducks fattened and the turnips saved.

‘When we get on a little farther with our inquiries into the history of animals, and especially such little things as insects, you may depend on it we shall find the best way to check the increase of any hurtful kind is to encourage any other animal, whether beast, bird, fish, or insect, that makes the injurious one its prey.’

Hand-picking has also proved serviceable, but I am not aware of any other plan that is of the least practical use in destroying this insect. The rule which Mr. Newman has laid down is a most admirable one, and is worth the attention of all cultivators of land, whether for farming or horticultural purposes. The ‘Nigger’ larva is shown on Woodcut XXIX. Fig. *b*.

THERE is a closely allied genus, called *Selandria*, the larvæ of which are singularly unpleasant to the eye, as well as injurious to vegetation. They continually exude from the sides of the body a thick, sticky liquid, of a greenish-black colour, in which they are completely enveloped. This is evidently used as a means of concealment, for the larva does not move so long as daylight endures, but flattens itself to the object on which it is resting, and looks like a mere lump of unpleasant slime that has accidentally fallen upon the tree. In America these larvæ go by the popular and expressive name of Slug-worms, and often do great damage to the peach, the plum, the cherry, the quince, and similar fruit-trees.

NEXT in order comes the insect which is shown on Woodcut XXIX. Fig. 4. Its name is *Allantus scrophulariæ*.

In this genus the abdomen is longer and more slender than in the preceding genera, the hind pair of legs are comparatively long, the clypeus is deeply notched, and the antennæ are rather slender, the third joint being longer than the fourth. One of these antennæ is shown at Fig. *g*. The cells of the wings are formed like those of *Athalia*. These insects are very plentiful, and are decidedly pretty, the abdomen being coloured with bright yellow or green, the former hue predominating. In the present species the antennæ are rather short and thick, but in some they are much longer. There are between forty and fifty species of this large genus.

The larva, which is shown at Fig. *c*, feeds upon the Figwort

(*Scrophularia*), from which the insect derives its specific name. It has twenty-two feet, and varies much in colour after its changes of skin. When it is full-fed, it leaves the plant on which it has fed, and burrows beneath the soil at its root, making for itself a cell below the surface of the earth, but not spinning a genuine cocoon.

ON Woodcut XXIX. Fig. 2, is a rather remarkable Saw-fly, called *Cræsus septentrionalis*. In this genus the antennæ are composed of nine elongated and slender joints, as may be seen at Fig. *e*. The wings have one marginal and four sub-marginal cells, and into the second run two small nervures, called 'recurrent' nervures. The hind legs are large, and the first joint of the tarsi very large and flattened. There are many species of this genus, and the present species is a very pretty one. The head, thorax, and base of the abdomen are black and shining, and the rest of the body is bright red. The legs are black, diversified with many white patches, as seen in the illustration. The name *Cræsus* is given to the insect in allusion to the golden red of the abdomen.

This is a very local insect, and though not generally spread throughout the country, is tolerably plentiful in places where it does exist. Mr. F. Smith tells me that he has taken it near Poole, feeding upon the alders that grew upon marshy ground. Mr. Doubleday has taken it in Epping Forest, feeding on the filbert. The larvæ are partly gregarious, dull green in colour, spotted with black, and changing to yellow at the end of the body. When they are alarmed, they protrude from between the fore-legs a number of blackish tubercles, and withdraw them when the danger has passed away. Like the larvæ of the *Cimbex*, they roll themselves up if touched. When full-fed, the grub seeks the ground, and constructs under the surface a small cocoon, brown in colour, and very slight in texture. Darenth Wood is mentioned as one of the localities in which it is to be found. The larva of this species is shown at Fig. *a*.

THE fine insect shown on Woodcut XXX. Fig. 2, belongs to the typical genus of this family, and is known as *Tenthredo zonatus*. This genus has the antennæ long and slender, the third joint not being longer than the fourth. The wings have

two marginal and four submarginal cells, and the abdomen is rather long and flattened. The present species differs considerably in colour, according to the sex, the male being almost entirely yellow, while the female is black, with a broad yellow band or zone across the body, as is seen in the illustration. The specific name *zonatus*, or banded, refers to this yellow belt in the female. The male is rather smaller than the female, but his inferiority in size is compensated by the superior brilliancy of his colour.

— Most persons who possess, or who take an interest in gardens, have noticed how liable is the gooseberry to be destroyed by a caterpillar-like grub. This is the larva of a Saw-fly called *Nematus grossulariæ*, an insect which is more pretty than it is agreeable. The insects of this genus have nine joints to the antennæ, and in the wings there are one marginal and four submarginal cells, into the second of which run two 'recurrent nerves.' The tarsi are not dilated.

When these larvæ take possession of the gooseberries, it is most difficult to extirpate them, and I believe that nothing but handpicking will answer the purpose. Mr. Waterton's plan of 'dishing' the gooseberries, i.e., cutting away the centre and training the branches so as to radiate in the form of a hollow cone reversed, makes this operation much easier, as well as permits the gooseberries to be gathered without risk of pricking the fingers. As many as a thousand larvæ have been found on a single gooseberry bush, and as there are two broods in a year, the mischief which they can do is almost incalculable.

Throughout their imperfect stages, these creatures are social, and their cocoons may be found in great numbers, attached to each other by their ends. The colour of the larvæ is a smooth leaden hue, and across their bodies are many rows of tiny black, hair-bearing warts. There are many species of this genus, which feed upon various trees, and which do much damage, not only in the orchard but in plantations, the willow, alder, osier, &c., being specially subject to their attacks.

ON Woodcut XXX. Fig. 4, is a slightly magnified figure of a Saw-fly with rather curious habits. This is the PINE SAW-FLY (*Lophyrus pini*). In this genus the male is always less than

the female, and may be distinguished by the form of the antennæ. In the female these organs are comparatively simple, as is shown at Fig. *e*, but in the male they are deeply and doubly toothed, the teeth being very much longer on the inner than on the outer side. One of these antennæ is shown on Fig. *d*.

In this species, the male and female also differ greatly in colour, the former being wholly black, while the latter is yellow, with a black head, and broad black-grey band across the middle of the abdomen. The comparative proportions of yellow and black vary much in different specimens. As its name imports, this insect feeds, while in a larval state, on the pine, and consequently is found more plentifully in the northern than in the southern parts of Europe. Happily, in this country, it is rather a scarce insect, but in some of the pine-growing districts of Northern Europe it does considerable damage.

The larva which is shown at Fig. *b*, is dirty yellow in colour, diversified with black spots arranged longitudinally. Like the larva of the *Nematus*, it is social in its habits, and may be found in groups, numbering a hundred or so, upon the pine-trees, feeding upon the leaves. Their mode of eating the needle-like leaves of this tree is from tip to base, and has been graphically compared to the manner in which men eat radishes. When the leaves are finished, the larvæ proceed between the young shoots, which they completely strip of their bark, and so proceed from one branch to another, rendering them as leafless as if the trees were dead.

Owing to the nature of their food, they naturally swallow a large amount of pure resin, and, if they are touched, they allow a drop of liquid resin to flow from their mouths. When they are full-fed they proceed to envelope themselves in cocoons, which are attached to the pine-leaves, and it is remarkable that the cocoons of the female insects are larger than those of the male. One of these cocoons is shown at Fig. *c*. The perfect insects make their appearance about May. Only a very few British species of this genus are known.

THE Saw-fly which is represented on Plate IX. Fig. 4, belongs to a genus named *Lyda*, in which the larvæ of the different species vary remarkably in their habits. In this genus the

antennæ are not feathered, and their joints vary in number from nineteen to thirty-six. There are two marginal and four sub-marginal cells, and the tibiæ of the second and third pairs of legs have three spines. The name of the present species is *Lyda hortorum*, and it is a really pretty insect. The head and thorax are black, and the abdomen a very warm orange red. The wings are peculiarly shining. Mr. F. Smith tells me that it is a very erratic and uncertain insect in its appearance, being found in plenty one day, while on the next not a solitary specimen is to be seen. It is exceedingly active and difficult to catch, and while flying, its wings glitter in the sunshine as if they were made of burnished gold.

The larvæ of this genus have no pro-legs on the abdomen, but at the end of the body are two jointed projections somewhat resembling the true legs of the thorax. In consequence of this structure, the movements of the larvæ are slow and of a gliding character. The larvæ are semi-social, and live in company after a very curious fashion. A number of them associate together upon a branch, each larva spinning for itself a separate case in which it lives, while the entire association is covered by a common roof formed of the leaves of a tree fastened to each other with silken webs. The larvæ of some species of *Lyda* form their cases of leaves, which they roll up into a cylindrical form, and in which they live like the caddis-worms in their tubes.

WE now come to a remarkable group of Saw-flies, which at first sight scarcely seem to belong to the same family as those which have just been mentioned. They are, indeed, so different in aspect that many systematic entomologists have formed them into a separate family, named Uroceridæ, i.e. Horn-tailed Saw-flies. In these insects, the saws are modified into a powerful boring apparatus, by means of which the female insect can drill a hole into solid timber, instead of merely cutting a groove in soft bark. The body is nearly cylindrical in form, but flatter in the males than in the females. The prothorax is elongated, and forms a sort of neck between the head and the thorax. The mandibles are strong and horny, though small; and the front tibiæ have one spur at the tip, and in the males the hinder tibiæ are flattened.

On Plate IX. Fig. 7, is shown one of these remarkable Saw-flies, called *Sirex* or *Urocerus juvenicus*. The specimen is a male, so that the very long ovipositor is not shown. In this genus the neck is a very short one, there are two marginal and four sub-marginal cells, the maxillary palpi are very short, and the boring instrument is very long, and exterior to the body. The colour of the present species differs greatly according to sex, the male being black and yellow, while the female is a very deep violet, almost amounting to black.

I very strongly recommend any of my readers who may obtain a female *Sirex* to disengage the actual borer from its two-bladed sheath, and examine it with the aid of a microscope. A half-inch object-glass will give quite sufficient power. It is straight, stiff, and elastic, as if made of steel, and, if bent, will spring back to its proper form with the elasticity of a Toledo rapier. In form it somewhat resembles the instrument known technically as a 'rymer,' except that the edges are rounded, and not square. But the borer possesses an auxiliary cutting apparatus which places it far above the rymer in point of efficacy. Even with an ordinary magnifying lens, it is easy to see that the end of the borer is developed into a sharp head very much resembling that of a boarding-pike, and that the outline of the shaft is broken into a series of notches.

The half-inch glass, however, discloses a marvellous example of mechanical excellence. The head of the borer is then seen to be armed with long, sharp teeth, slightly curved inwards, and acting just as does the carpenter's ordinary centre-bit. So much for the head of the borer: we will now turn to the shaft. It appears that, in order to make a clean-cut hole for the reception of the egg, the shaft of the borer has to finish the task which the head begins. Accordingly, it is armed on each of its sides with a series of hard, sharp-edged ridges, running diagonally across it, and acting exactly as do the sharp ridges of a coffee-mill. A more effective implement could not have been invented, and the various boring instruments of modern days, however novel they may appear to be, are in reality formed on exactly the same principle as the borer of the *Sirex*, though perhaps they may not carry out their object with such perfection.

This is a wood-boring insect, the female drilling a hole in the solid wood, usually that of the fir, and depositing her eggs in

it. It is thought by many naturalists that the *Sirex* never attacks growing trees, but restricts itself to those which are either dead or dying. The late Mr. Waterton was of this opinion. Shortly before his lamented death he showed me two fir-trees which he had 'girdled' in order to kill them, for the purpose of seeing whether or not the *Sirex* would attack them. Unfortunately, the accident from which he died put a stop to the experiment.

It is, at all events, certain that the *Sirex* does exist in dead timber, and nothing is more common than to see a newly erected summer-house absolutely infested by the *Sirex*, which, although harmless enough, looks so like a hornet that scarcely any persons who are not practical entomologists can believe that an insect so formidable in appearance, and armed with so huge a sting, can be anything but dangerous.

In Curtis' 'British Entomology' it is mentioned that the *Sirex* has made its appearance in York Minster, a number of the males having been captured as they were flying about the tower; and Mr. Curtis took occasion to prognosticate danger to the tower, not only from the weakening of the timber, but from its increased liability to combustion, owing to the numerous tunnels with which it is perforated.

I have quite a collection of these insects, sent to me by persons who have found them in newly-panelled rooms, in summer-houses, and similar localities, and who have been quite alarmed at their presence. These, however, mostly belong to another species, *Sirex gigas*, the female of which is yellow and black, like the male, and which therefore looks much more like a hornet than its relative, *Sirex juvencus*. It is really a splendid insect. One that I have taken at random from a box measures an inch and a half from the head to the end of the tail, the spread of wing is two inches and three quarters, and the boring apparatus, which is as large as a 'No. 5' needle, is rather more than an inch in length, so that if people mistake it for a poison-bearing sting, they are likely to be afraid of the insect.

The colouring of this insect is peculiarly bold. The head is thickly punctured, and deep black, except a patch of bright yellow behind the eyes. The thorax is also black, punctured, and covered with a coating of fine black down. The abdomen

is bright ochreous yellow, with the exception of a broad satin-like belt round the middle, the colour being black, glossed with violet. The boring instrument is brown, with a slight tint of red in it. The femora, or thighs of the legs, are black, and the rest yellow, and the antennæ are yellow. Even the wings have a decided yellow tinge about them.

The reader may remember that most wood-boring insects are exceedingly variable in size. The *Sirex* is no exception to the rule, for, while some specimens are almost gigantic in dimensions, others are the merest dwarfs by their side.

The larva bears some resemblance in general form to that of the Musk Beetle, described on page 195. The mandibles are very strong, and furnished with saw-like teeth at the end, their action being as remarkable as it is powerful. They remain in the larval state for a considerable time; but the duration of the pupal existence depends much on circumstances, those which change to the pupal condition in the summer only waiting a month or so, while those which change at the end of autumn have to wait for nearly a year.

As a rule, none of the species of *Sirex* are very common in this country. They are, however, tolerably plentiful in the neighbourhood of my house, because there is a small fir-wood within a hundred yards of it, and that wood has been fenced off by a paling made from the misshapen firs. That they may be thus locally common may be seen from an account published in the first volume of the 'Transactions of the Entomological Society.' A part of a fir-tree, some twenty feet long, was placed in an outhouse, and for several months the *Sirex juvenis* issued at the rate of five or six *per diem*. At first they were nearly all males, then a few females appeared, and during the last two weeks, i.e. the end of November, females alone made their appearance. The piece of wood in question was sent to the Society by Mr. Raddon, from Bewdley Forest, Worcestershire.

AN enormous group of Hymenoptera now comes before us, appropriately entitled ENTOMOPHAGA. This name is formed from two Greek words, signifying 'insect-eating.' It is given to them because, in the larval state, the greater number of them are parasites within other insects; usually, but not always, attacking them while still larvæ. In them the abdomen

is attached to the thorax by a very small portion of its diameter, and is often lengthened into a more or less slender footstalk. The females are furnished with an ovipositor composed of several valves, and similar in most respects to that of the *Sirex*. Mr. Westwood arranges them in two groups; the one, which he calls *Spiculifera*, having 'two delicate spicula, working in a horny semi-canal, which is defended at rest by two often partially exerted valves.' The second division includes those in which the abdomen is terminated by a telescopic retractile tube.

The first family is the *Cynipidæ*, popularly known as Gall-flies, in which the ovipositor is internal and more or less spiral, and the antennæ are straight and have from thirteen to fifteen joints. By means of the ovipositor, the female insect punctures various portions of plants, the ribs and nervures of leaves, young twigs and roots, being the favourite objects, and by the same instrument she introduces an egg into the wound, together with a drop of some irritant liquid. The effect of this liquid is very curious. It mixes in some way with the sap of the tree, which causes a swelling to take place, in the middle of which the egg is hatched into a larva, and finds at once its board and lodging combined. As is the case with the Saw-flies, the egg of the Gall-fly enlarges after it is deposited, until it is three or four times as large as when it was first deposited.

The varieties of galls, in shape, colour, and size, are almost beyond calculation; for, despite the enormous number of Gall-flies that are already known, new specimens are still being discovered, and every species makes its own gall. How the instilled liquid acts no one knows, and there are few more curious problems in nature than that which the growth of the gall involves. Were each kind of tree, for example, to produce one kind of gall, it would be easy enough to understand that the irritating liquid introduced by the insect would produce a certain sort of abnormal swelling. But when we find that a variety of Gall-flies attack one tree, such as the oak, and that each produces an entirely different gall, the problem is a very perplexing one. In many cases, such as the well-known currant-gall, the nut-gall, and the hard, woody gall of *Cynips Kollari*, which is shown on Plate IX. Fig. 6, each gall has but one inhabitant. But in

others, of which the common 'oak-apple' gall and the 'bedeguar' of the rose are familiar examples, a number of cells are enclosed in a common gall, and each insect inhabits its own cell.

WE will now examine in detail a few of the most prominent insects of this group. The insect on Plate IX., to which reference has just been made, belongs to the typical genus of the family. By some entomologists it is called *Cynips Kollari*, in honour of the well-known entomologist, and by some it is entitled *Cynips lignicola*, in consequence of the hard and almost woody structure of the gall. In this genus the abdomen is rather egg-shaped, and there is a small, but boldly marked triangular submarginal cell. The antennæ of the male have fifteen, and the female fourteen joints. The colour of this species is dull plain brown.

The rapid manner in which insects can spread themselves over a district when the conditions are favourable is well exemplified by this Gall-fly. Comparatively a few years ago it was unknown in the vicinity of London. But Mr. F. Smith brought from Devonshire a branch on which were a number of the galls, and fastened it in an oak hedge. Next year the oaks bore these galls in numbers, and the insect has so rapidly made its way that its galls are now better known than those of any other species. They are so plentiful that they are even strung on wires, and made into ornamental baskets for holding ferns. I have in my garden an oak hedge which is thickly studded with the round, hard galls. Even in summer-time, when the leaves are on the trees, these galls are easily seen; but in the winter, when no foliage obstructs the sight, they are the most conspicuous objects in the hedge. In this part of the country, i.e. West Kent, there is great abundance of oak underwood, and in consequence this species, in common with other oak-loving insects, finds ample subsistence.

I have had great numbers of these Gall-flies, and when the first batch escaped from the galls, I was sadly disappointed at the dull, sombre brown colour, and altogether commonplace look of the insect. Still, owing to the size of the *Cynips*, the structure of the ovipositor can be easily made out with the aid of a tolerable microscope and a fair stock of patience.

Sometimes two, or even more, of the galls will be made so close together that they coalesce to a greater or smaller degree. I possess one rather remarkable instance of this fusion. Contrary to the general practice, the instinct of the enclosed insect misled it. After the pupa has changed into the perfect state, the *Cynips* gnaws its way through the substance of the gall, and so gains the outer air. The distance to be traversed is about half an inch, and the insect has quite enough strength to accomplish the task. But, in the instance of which I speak, one of the Gall-flies had mistaken its way, and, instead of directing itself to the point which would lead it most directly into the open air, unfortunately took exactly the opposite direction, and hit upon the very spot where the galls were joined after the fashion of the Siamese twins. Consequently, instead of having to gnaw its way through a wall barely half an inch in thickness, it had to traverse an inch and a half before it could reach the air. Very naturally, its strength was exhausted before it could perform such a task, and I found it lying dead on the spot where the galls were joined.

To me, one most interesting point was to observe the economy of Nature even in so small an insect as a Gall-fly. Normally it has to bite its way through half an inch of material, and it has strength for that purpose. But it has not more than sufficient strength, and so it happened that the insect in question, after traversing its allotted half inch, had no strength to proceed further, and so died on the scene of its uncompleted labours.

An insect so plentiful, so conspicuous, and so sluggish might be supposed to suffer much from birds. It has, however, been well observed that this species has, when handled, a very disagreeable odour, and that therefore the birds may reject it, as is known to be the case with many other insects.

It is impossible, with the limited space at our command, to do more than give this brief sketch of the life of a Gall-fly. There are very many other species, some of which are exceedingly beautiful and others comparatively dull. Breeding them from the gall is a very interesting pursuit, but I must warn the novice in this art that, although he may hatch a number of Hymenoptera from galls, it does not by any means follow

that they are its lawful inhabitants; for there are certain ichneumon flies (of which we shall presently treat) which are parasitic upon the gall insects, and take their place within the galls.

Some of the habitations produced by these insects are very beautiful. For example, the leaf-galls of the oak are of a pearly translucency, and coloured with golden yellow, orange, and red, like a ripe apple. The currant galls, which hang in strings from the twigs, are similarly beautiful in colouring, while the rich crimson bedeguar of the rose, with its thick, fur-like clothing, is too familiar to need description.

To secure the insects which inhabit these galls is easy enough. Those which are found at the middle or end of autumn may be plucked, together with the part of the tree to which they are attached, and placed in boxes, each box being carefully labelled with the date and locality of the capture. But when the galls are found at the beginning of summer, this plan often fails, because the galls are still drawing nourishment from the sap, and, unless they can do so, the insect does not obtain sufficient nutriment, and either perishes before it can make its way through the partly dried walls of its habitation, or is itself withered, shrivelled, or deformed, in consequence of the deterioration of its food.

In such cases, the best plan is to take a piece of green muslin or leno, and tie it loosely over the gall. In gardens or private grounds this is always the best plan, and, even in places open to the public, the green muslin will mostly escape observation. Indeed, it is often so difficult to discover, that the safest plan is to note in the pocket-book the particular tree and branch on which any galls have been thus secured. It is rather curious that, although the Gall-flies can gnaw their way through the walls of their former habitations, they seldom, if ever, try to break through the gauze in a similar manner, but crawl about in an uncertain way, as if bewildered with their new position.

THERE is one small but remarkable family of these insects, called the Evaniidæ, in which the relation, size, and position of the abdomen and thorax are most curiously modified. Like several other groups of insects now inhabiting Britain, they

are thought by many entomologists not to be indigenous, but to have been brought over by vessels, and to have acclimatised themselves.

In these insects the thorax is enormously large, and the abdomen is curiously small, scarcely larger, in fact, than one of the hind-legs. It is very slender, and attached to the upper part of the thorax by a slight footstalk, just below the insertion of the wings. In some species, the abdomen is barely half the size of one of the hind legs, and bears about the same relative proportion to the thorax that a comma (such as this ,) bears to the capital letter O. In fact, the creature seems to be all legs and wings, without any nutritive apparatus.

All the Evaniidæ are small, but we may gain some idea of their remarkable construction if we take the head, thorax, legs, and wings of a wasp, remove the abdomen altogether, and substitute the corresponding part of a gnat, stuck on the upper part of the thorax, just at the base of the wings. Only, to make the resemblance clearer, we must make the hind legs nearly twice as long, and flatten the tibiæ into triangular plates. The Evaniidæ are parasitic in their nature, but their economy is not yet thoroughly known.

CHAPTER II.

THE ICHNEUMON FLIES.

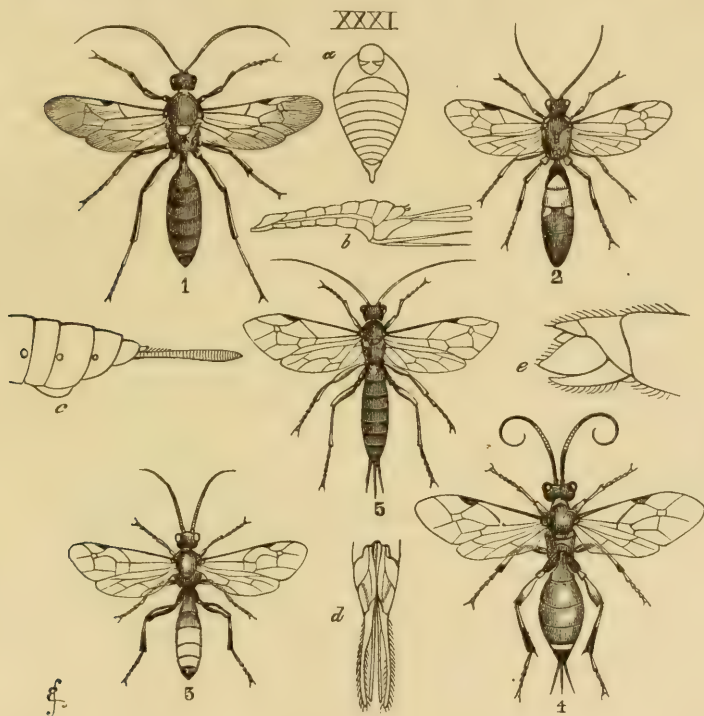
WE now come to the Ichneumonidæ, one of the largest, most important, and most perplexing groups in the insect world. They are termed Ichneumonidæ, or Ichneumon-flies—because they enact the same part towards various insects that the ichneumon was said to act towards the crocodile. They are parasites upon other insects, and for the most part they spend their larval existence within the bodies of their victims, where they lurk unseen and unsuspected until the time comes when they have to change their forms. In this family the abdomen is attached to the end of the thorax, and not to its upper part, as in the Evaniidæ, and the first pair of wings have always ‘perfect’ cells, i.e. cells closed on all sides within their disc. The ovipositor of the females is straight, and the antennæ are not elbowed. There are many other characters of this family, but these are sufficient for identification.

The first and typical genus of this family is Ichneumon, in which the abdomen is rather egg-shaped but oblong, and the ovipositor is not external. The antennæ are linear, and the wings have the areolet five-sided and boldly marked. The outer cell is complete.

Our first example of this genus is given on Woodcut XXXI. Fig. 1, and is called *Ichneumon proteus*. Why it should have obtained the name of Proteus is more than I can understand. The name decidedly implies that it is exceedingly variable in some way, but in a long series that I have examined I could not find any variation worth noticing. The colour of this insect is black, with a yellow scutellum, and a yellowish patch in the middle of the antennæ. The wings are translucent, but shaded toward the tips.

At Fig. 2 of the same Woodcut is shown the male of another

species of this genus, *Ichneumon crassorius*. In this insect there is a bold distinction between the two sexes, the females being altogether black, with the exception of a yellow scutellum, and the males having a broad band of orange-yellow across the middle of the abdomen. When a female of any large species of *Ichneumon* is caught in the hands, she uses her ovipositor as a weapon of offence, by bringing its sharp point against the skin. She cannot do any injury, for she has no



1. *Ichneumon proteus*. 2. *Ichneumon crassorius*. 3. *Tryphon rutilator*. 4. *Cryptus migrator*. 5. *Pimpla instigator*. a. *Tryphon*, larva. b. *Pimpla instigator*, female, profile of abdomen. c. Do., dried specimen. d. Do., seen from beneath. e. Do., abdomen of male.

poison apparatus, and the ovipositor is too feeble even to penetrate the skin. She can, however, prick sharply enough to cause a novice to think that she really has a sting, and to release her accordingly.

WE now come to the genus *Tryphon*, in which the tarsi of

the hinder legs are very slender, the abdomen has a very short footstalk, and the areolet is not well defined, but is either triangular, or approaching to a circular form. One of these insects, *Tryphon rutilator*, is drawn on Woodcut XXXI. Fig. 3.

The present species is exceedingly variable, but in general the head and thorax are black, and the abdomen dull red in the middle, with a black base and tip. A rather curious circumstance has occasionally happened to one or two species of this genus. The eggs had been extruded—probably by pressure when the insect was caught—and remained at the end of the abdomen, where they were hatched. Having no proper food, they commenced feeding on each other. One of the larvæ is shown at Fig. a.

ON Plate X. Fig. 3, is seen a very fine Ichneumon-fly, which is called *Trogus atropos*. In this genus the scutellum is elevated, the head is large and wide, the abdomen is joined to the thorax by a footstalk, is convex, and the ovipositor is not protruded. The colour of this species is black, with the scutellum and the basal half of the abdomen yellow.

This insect preys upon the caterpillar of the Death's Head Moth (*Acherontia atropos*), one of which is partly shown in the middle of the Plate. Those who rear moths from the caterpillar are too familiarly acquainted with the Ichneumon, for it often happens that, after watching and cherishing a caterpillar until it is full-fed, the creature dies, and from its withering body proceeds the splendid but objectionable Ichneumon. It is in consequence of choosing this caterpillar that the name of Atropos has been given to the insect.

Another species of Ichneumon is shown on Woodcut XXXI. Fig. 4, and is called *Cryptus migrator*. In this genus the ovipositor is rather long and protruded. In other respects it agrees with the preceding genus. This is rather a variable species, but in general it is black, with the exception of the abdomen, which is dark-red. It is parasitic on solitary bees, belonging for the most part to the genus *Odynerus*. The name *Cryptus*, which signifies hidden, was given to the insects on account of the manner in which they lie hidden in the bodies of their prey until they are developed. This is a very large genus, containing some sixty species.

On Plate X. Figs. 2, 3, and 6, are drawn two species of a most curious little Ichneumon, which might easily be thought not to be a winged creature at all. In this genus the abdomen has a footstalk, and the ovipositor is short and protruded. The wings are unfitted for flight. The generic name of *Pezomachus* is Greek, and signifies a foot-soldier. It is given to those insects because the females are unable to use their rudimentary wings.

At Figure 6 is represented the female of *Pezomachus zonatus*. The head of this species is black, and the rest of the body is yellow, with the exception of two black belts across the abdomen, from which the insect derives its name of *zonatus*, or belted.

In *Pezomachus fasciatus*, which is seen at Fig. 3, the female is entirely without wings. Its colour is yellow, and it has a single black band on the abdomen, from which it derives its specific name of *fasciatus*, or banded. In one species, *Pezomachus hemipterus*, the female has very short wings with black tips. They are, however, merely rudimentary, and quite incapable of flight. The specific name of *hemipterus*, or half-winged, refers to this structure.

The *Pezomachi* are parasitic on spiders, and can be almost always obtained by using the sweep-net among grass and bushes where the spiders' nests abound. There is a very common spider, called *Agelena brunnea*, which makes its nest on furze and grass, and then covers it with earth, so as to hide the white, glittering silk of the nest itself. From these nests the *Pezomachus* may often be hatched. In all cases, the male is much rarer than the female, and the surest mode of procuring it is to take a number of spiders' nests and await the exit of any *Pezomachi* that may happen to have been parasitic on them.

ONE of the larger species of Ichneumons is represented on Woodcut XXXI. Fig. 5. Its name is *Pimpla instigator*. In this genus the abdomen has no footstalk, and is smooth and convex, with the segments marked by tubercles. The areolet is triangular, and the ovipositor is protruded.

The colour of this species is black, and the legs are reddish. It is a wonderfully variable insect in point of size ; some speci-

mens being as large as the figure, if not larger, while others are no bigger than gnats. The mode in which the *Pimplas* deposit their eggs is well told by Mr. Westwood:—

‘May 29, 1830, I observed a *Pimpla*, with the ovipositor almost as long as the body, in the act of oviposition in a dry paling, which had been much perforated, and out of which I had just dug a black *Pemphredon*. The part in which the ovipositor was introduced appeared to be quite solid. (Réaumur represents his specimens as inserting their ovipositors in a circular patch of dried clay, used to stop up the entrance to the nest of the intended victim.) There were several very minute blackish spots, as they seemed to be, close to the place where the ovipositor was inserted, and which were probably other places of insertion of the ovipositor.

‘When first observed, the insect had introduced about half the terebra into the post, the part remaining uninserted being at right angles with the body, the sheaths being curved and their tips being brought to the place of insertion, thus evidently strengthening the terebra in its operations. The abdomen was at this time alternately turned from left to right, and *vice versâ*, whereby a bradawl kind of motion was given to the terebra, enabling it to penetrate the wood to a greater depth. It then alternately partially withdrew and replunged the terebra into the hole thus made, as though in the act of passing an egg or eggs, standing all this while on the tips of the tarsi. On cutting, however, into the post, I was not able to discover any lignivorous larva, finding only a channel of fine, white pulverised wood, which had been made by a previous occupier of the tube.’

Some further details of this insect are given on Woodcut XXXI. Fig. *b* shows the lateral view of the female abdomen in a fresh insect, and *c* is the same portion of a dried specimen. Fig. *d* shows the abdomen as seen from beneath, and Fig. *e* shows the end of the male abdomen.

SOME of the Ichneumons have wonderfully long and slender ovipositors. One of them, *Rhyssa persuasoria*, is shown on Plate X. Fig. 5, one being seen in the act of depositing her eggs, and the other to be flying. In this genus the abdomen is without a footstalk, long, convex, and furnished with a very



PLATE X.

PARASITIC HYMENOPTERA.

1. *Pezomachus zonatus* and nests of Spider.
2. *Pezomachus fasciatus*.
3. *Trogus atropos*.
4. *Rhyssa persuasoria*.
5. *Rhyssa* depositing eggs.
6. *Chelonus oculator* (rather magnified).
Caterpillar of Death's Head Moth. In Middle.

PLANTS :—

Willow. Above.

Dog-grass (*Cynosurus*). In Middle, with mud-nests of Spider.

Wood Sorrel (*Oxalis acetosella*). Below.



long ovipositor. The present species is nearly as variable in size as the *Pimpla* which has just been described. Its colour is black, diversified by bright yellow spots along the sides of the thorax and body, as seen in the illustration. Like some other Ichneumons with very long ovipositors, it is parasitic on larvæ which burrow into solid wood.

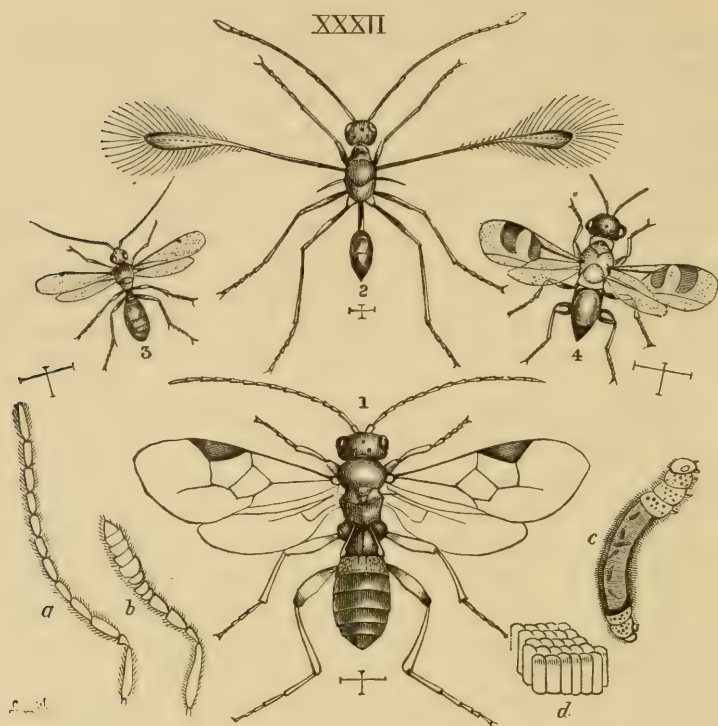
ON Plate X. Fig. 6, is seen a magnified figure of a curious insect, called *Chelonus oculator*. In this genus there are two submarginal cells, the first of which is not complete. The eyes are hairy. This species is not a common insect, and seems to be a local and recurrent one. Mr. F. Smith tells me that in one day he took more than fifty specimens, by sweeping the grass on the top of the cliffs at Lowestoft, and that he has hardly ever seen as many since as he took on that one occasion. The colour of the insect is black, some specimens, particularly the males, having a yellow band across the abdomen. It is, however, very variable both in size and colour. The economy of this insect is very curious, and is not thoroughly cleared up.

ON Woodcut XXXII. Fig. 1, may be seen a much magnified illustration of a very small but singularly useful insect—so useful, indeed, that without its aid we should scarcely be able to raise a single cabbage. This is called *Microgaster glomeratus*. In this genus the eyes are hairy, the antennæ long and consisting of eighteen joints. The present species is dark-bodied, and its wings are translucent, but, when viewed through the microscope, are wonderfully beautiful, glittering with every hue of the rainbow as the light plays over them.

This little insect is parasitic on the common Cabbage-caterpillar, i.e. the larva of the Great Cabbage White Butterfly, and so rapidly does it multiply that, after watching its progress from the larva to maturity, it seems strange that a single Cabbage White Butterfly should be found in the country. Owing to its numbers, the young entomologist will find this insect an admirable one for experiments. If a hundred Cabbage-caterpillars be captured, there will be only one or two which do not contain the larvæ of the *Microgaster*. Their relative size in proportion to the caterpillar is shown at Fig. *c* of the same Woodcut, but neither their numbers nor their position.

If a 'stung' caterpillar be carefully dissected, so that the skin is removed from the body, the space between the digestive organs and the skin, which ought to be occupied by a layer of fat, is found to be literally stuffed with the tiny white grubs of the *Microgaster*.

The fatty substance on which these larvæ feed is intended



1. *Microgaster glomeratus*. 2. *Mymar pulchellus*. 3. *Teleas elatior*. 4. *Cleonymus maculipennis*. a. *Teleas*, antenna, female. b. Do., antenna, male. c. *Microgaster*, larva in caterpillar of cabbage-butterfly. d. *Microgaster alvearius*, cocoons.

as material from which the future butterfly is to be evolved. But, as it is almost entirely consumed by these internal foes, the insect seldom has sufficient strength to effect its change into the pupa—much less into the butterfly. Just in proportion as the fat decreases, the *Ichneumon* larvæ increase, so that to the eye the caterpillar looks quite plump and healthy, when it is in reality absolutely emaciated. Yet the presence of these

parasites seems to have no effect on the caterpillar, who eats as voraciously and grows as rapidly as if it were free from its internal devourers.

All, therefore, goes on apparently well, until the time when the insect ought to make its change to the pupal state, being full-fed, or at least as full-fed as it can be. But the larvæ of the *Microgaster* are full-fed too; and, just before the caterpillar changes into the pupa, they burst through it in all directions and leave it to die. Generally, it dies so soon that its shrivelled body remains in the midst of its enemies, and it seldom has sufficient strength to move more than a few inches away from them. The *Ichneumon* larvæ immediately begin to spin for themselves little yellow cocoons of silk, very much resembling that of a silkworm, and clustered closely together. I have noticed that those which come from one caterpillar generally congregate into two totally distinct clusters, those which occupied the different sides of the caterpillar remaining neighbours as before. The specific name of *glomeratus*, or clustered, refers to this habit.

Almost any number of these cocoon-clusters may be obtained from the walls, posts, or palings that adjoin kitchen-gardens; and the tree-trunks of the garden are equally prolific in them. If a cocoon be cut open with a very fine pair of scissors, the pupa may be seen lying in its silken cell, and, with a little care, the whole progress of the insect can be watched, from the larva to the pupa. I have dissected great numbers of cabbage caterpillars for the sake of observing the curious relationship between the caterpillar and the *Ichneumon*, and the development of the latter insect.

THERE is a closely allied species, named *Microgaster alvearius*, which in many things resembles the preceding species, but which has a different method of arranging its cocoons. Those of the preceding insect are arranged quite at random, or indeed can scarcely be said to be arranged at all, the larvæ spinning their cocoons without any reference as to the position in which they might happen to be at the time. But, the present insects when they are about to change into the pupal state, arrange their cocoons side by side with the greatest regularity, as seen at Fig. *d* on Woodcut XXXII. Masses of these pretty cocoons

can be found adhering to twigs, and from them the insects can be procured in considerable numbers. I find, on examining a series of these cocoon-masses, that the number of individual cocoons is somewhere about one hundred and fifty.

When the pupa changes to its perfect form, it gnaws a round hole at one end of the cocoon, so as to cut out a sort of lid, by raising which it can escape. Very often, the inverted lid is left in the cut end of the cocoon and closes it. The average length of the cocoon-cluster is nine-tenths of an inch, its width nearly a quarter of an inch, and the depth of cell one-tenth of an inch. The insects are pale and shining yellow, with the upper part of the abdomen and end of the thorax black.

WE now come to the great family of the Chalcididæ. These insects are parasitic, are for the most part exceedingly small, and many are very tiny indeed. The head is transverse, the eyes set on the sides, and the antennæ are short. The upper pair of wings are almost without nervures, though the course of one or two can be traced by careful examination with a microscope. The lower wings have only a single nervure. They are parasitic insects, many of them being actually parasitic upon other parasites, and some depositing their eggs in various galls, where they feed upon the rightful inhabitants, and in due time make their appearance, to the great perplexity of practical entomologists who have kept the galls for the purpose of rearing the particular Gall-flies which belong to them.

One of these insects, called *Cleonymus maculipennis* or *depressus*, is shown on Woodcut XXXII. Fig. 4.

It is a very pretty little insect, the colour being a deep metallic blue, changing to green and pink according to the variation of the light. The antennæ are red, tipped with black, and the abdomen is flattened, a characteristic which gained for it the name of *depressus*. The wings are prettily mottled with brown, as seen in the illustration. Mr. F. Smith says that he has often seen it running quickly about posts and rails, busily engaged in prying into every orifice, probably for the sake of detecting some wood-boring insect, in whose body it can lay its eggs.

In this genus the thorax is rather long and egg-shaped, the

antennæ have eleven joints, the second of which is longer than the fourth. The ovipositor is not protruded.

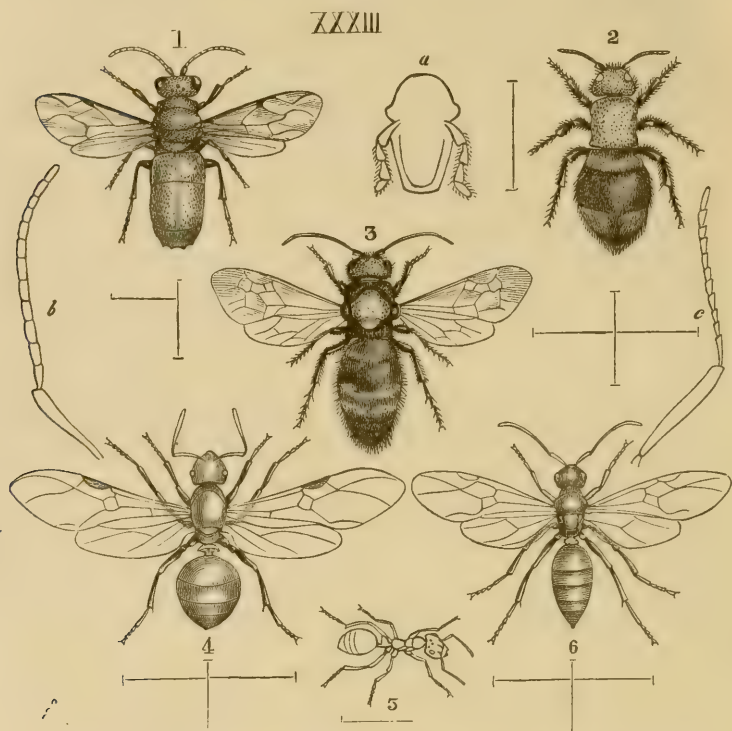
WE now pass to the family of Proctotrupidæ. This family comprises some of the smallest known Hymenoptera; indeed, many of them are so exceedingly minute that they can only be seen by the aid of a lens. In these insects the hind wings have no nervures at all, while those of the fore wings are but few in number. The antennæ have the first joint larger than the others, and in some species they are as long as the body.

One of the larger species is given on Woodcut XXXII. Fig. 3. Its name is *Teleas elatior*. In this genus the legs are formed for jumping, the abdomen has a footstalk, and the antennæ have twelve joints, and are hairy in the male. The male antenna is shown at Fig. *b*, that of the female at Fig. *a*. The colour of this species is very deep black-blue, and the wings are very iridescent.

The various species of this genus deposit their eggs in the eggs of other insects, particularly those of moths and butterflies, and so very minute are some of them that a single butterfly's egg will serve for the support of several *Teleas*' larvæ. By the assistance of these tiny parasites, it therefore happens that even the eggs of the Lepidoptera are destroyed before they can hatch, and so our gardens and crops are protected by friends so exceedingly minute that they can scarcely be seen without the aid of a lens.

ANOTHER example of this curious family is given on Woodcut XXXII. Fig. 2. It is called *Mymar pulchellus*. In this genus the antennæ of the male have thirteen joints, while those of the female have only nine. The first joint is very long and slender. The very remarkable little insect which is drawn in the illustration has the lower pair of wings reduced to mere bristles, and the upper pair are little more than two very long nervures with a broad fringe at the ends. This species may be taken with the sweep-net by brushing it over grass throughout the summer and autumn. This and other species are often found crawling up the window-panes of houses, when they can be easily taken by putting a pill-box over them.

THE next group of this enormous array of Hymenoptera is that which is called TUBULIFERA, or Tube-bearers, because the last segments of the abdomen are modified into a telescopic and retractile tube. The antennæ are elbowed. Only one family belongs to this group, namely, the Chrysididæ, popularly



1. *Chrysis ignita*. 2. *Mutilla Europæa*, female. 3. *Mutilla Europæa*, male. 4. *Formica rufa*, winged female. 5. *Do.*, neuter or worker. 6. *Do.*, winged male. a. *Formica rufa*, labium. b. *Do.*, antenna, male. c. *Do.*, antenna, worker.

called Ruby-tailed flies, and familiarly known on account of their splendid colouring.

At first sight the abdomen appears to consist of a very few segments, sometimes three, and five at the utmost, but, in fact, the missing segments are modified into the telescopic tube which has just been mentioned, and which is retracted within the body when not required for its legitimate purpose, namely, the deposition of eggs. The abdomen is attached to the thorax

by a very short foot-stalk. In consequence of the mode by which the abdomen is attached, the insect is able, when alarmed, to roll itself up into a ball, in which it is aided by the shape of the abdomen, the under surface of which is concave so as to receive the thorax. At the end of the retractile tube, is a small, sting-like ovipositor, capable, as I can testify from experience, of inflicting a smart prick when the insect is moved to anger. There is, however, no poison-gland, so that the prick, though it may startle, cannot injure.

The Ruby-tailed flies are among the most beautiful of our insects, and if they were only enlarged, might challenge the most gorgeous productions of the tropics for brilliant splendour. The head and thorax are coloured with vivid blue or green, and the abdomen is of a fiery ruby, looking, as the insect flits about in the sunshine, as if made of burnished metal. Five genera of these insects are known to inhabit England, containing altogether about twenty-four species. They are all parasitic upon other insects, mostly affecting the larvæ of solitary Hymenoptera, among which the well-known Sand-wasp (*Odynerus*) is so frequently the victim that Dr. Chapman, who has paid great attention to the Chrysididæ, states that 'the destruction caused by Chrysididæ amongst the young brood of *Odynerus spinipes*, roughly measured by the cocoons collected last winter, is in the proportion of one to three of those of the wasp.' The mode in which these parasitic insects achieve their task is so well narrated by Dr. Chapman that I cannot do better than quote his own words.

'On July 17th I observed a nest of *Odynerus parietum*, with one cell open, and containing a nearly complete supply of Lepidopterous larvæ. A *Chrysis ignita*, flying about, settled beside the cell; and, after a brief examination with her antennæ, wheeled round, and introducing her abdomen into the cell, rested for about twenty seconds, doubtless in the act of oviposition. I now regret that I did not then examine the contents of the cell, in order to ascertain the fate of the egg of *Odynerus parietum*. Three-quarters of an hour later, *Odynerus parietum* had closed the cell with the usual earthen pellets. Two days afterwards I examined this cell, when I found a larva of *Chrysis ignita* a quarter of an inch long, together with the Lepidopterous larvæ stored by the wasp, but

there was no trace of either egg or larva of the latter. On the 23rd, six days from the date of oviposition, the *Chrysis* larva had eaten all the store, and was full-fed. I obtained evidence, by finding the exuviae, of its having cast its skin three times, whilst under observation; and from the analogy of *Chrysis bidentata*, I believe it had done so four times altogether. The stored larvæ had all been eaten, their heads alone remaining, just as when eaten by the wasp grub. The larva then spun a cocoon, which I know to be typical of *C. ignita*. This was the only occasion on which I had a feeding larva of *C. ignita*, and the rapidity with which it fed up astonished me. None of my *C. neglecta* or *bidentata* fed up so rapidly; but the warm sunny wall on which *O. parietum* had built her nest may partly account for this, my larvæ of the other two species having been kept comparatively cool.

Chrysis bidentata, when about to deposit her eggs, searches for a full-grown larva of *Odynerus spinipes* at, or immediately after, the period of spinning. *O. spinipes*, on the completion of her burrow, fills up the mouth with clay long before the most accessible cells can contain full-grown larvæ; but it happens that, in a large proportion of cases (about half), the wasp meets with some accident, and her burrow remains uncompleted, the cell last constructed being thus only protected by the wall of clay that was to serve as a party wall between it and the succeeding one, had the wasp lived to complete her work. Such slightly protected cells are those chosen by *C. bidentata* for her oviposition. I once found satisfactory evidence of *C. bidentata* having burrowed through half an inch of the clay stopping placed by the wasp over one of these cells. The parasite was in the burrow, covered with the dust brought down into it by her excavation to form an entrance—a passage too small for the wasp to enter, but just large enough for herself; and in the cell thus reached by her were to be seen her eggs, freshly deposited. On another occasion, a *C. bidentata* alighted on a spot I was examining, and where I had partially exposed some cocoons of *O. spinipes*: she commenced to carefully investigate them with her antennæ, and now and then to scratch away some earth partly covering them; she did not, however, deposit any egg, possibly because the inmates of the cocoons were not in proper condition.

‘When a cocoon contains eggs of *C. bidentata*, there is often to be found, at its upper end, a minute aperture, through which the ovipositor of the Chrysis has been thrust; at other times, this aperture is wanting, simply, I believe, because the larva of *O. spinipes* had not done spinning her cocoon when the Chrysis deposited her eggs within it. There is nearly always a small spot outside on the yellow silken top of the cocoon, as if the Chrysis had attacked it first with her jaws; and those containing *C. bidentata* may be selected by this mark from a number of cocoons of the Odynerus.

‘The young larva of *C. bidentata* seizes that of *O. spinipes* with its jaws, pinching up a fold of skin, and contrives to extract fluid nutriment from it, without, apparently, making any aperture in the skin, until it approaches to mature growth itself. I have very carefully examined larvæ of *O. spinipes* that were thus half sucked away (I cannot say eaten), and I could find no mark at the spot whence I had just removed a larva of Chrysis. I have several times squeezed the Odynerus larva firmly, without any fluid exuding: even when squeezed almost to bursting, on only one occasion did a drop of clear fluid exude. Nor is the Chrysis larva particular as to where it seizes the Odynerus, any point that may offer itself to its jaws being seized.

‘When the devourer is nearly full-grown, and the victim is very flaccid, a process that may be called eating takes place, and the spinipes larva almost entirely disappears. The manner in which the larvæ of *C. neglecta* and *ignita* and of *O. spinipes* itself eat the little green grubs is precisely similar. When young, they merely suck the juices of several, and sometimes return to and finish these when they are larger, but they may often be found neglected when the larva is full-grown.’

These insects are wonderfully persevering in their attempts to deposit their eggs. A French naturalist mentions that he saw one of them enter the nest of a solitary bee which builds in the holes of walls, while the bee was absent in search of the pollen on which the young larva was to feed. She happened to return while the Ruby-tail was still in the nest, and at once attacked the intruder, which endeavoured to avoid her jaws by rolling into a ball, after the fashion of her kind. The bee, however, persevered in her attacks, bit off all the enemy’s wings,

dragged her out of the nest, threw her to the ground, and proceeded to deposit her load of pollen in the cell. She then flew off in search of a further supply, when the Ruby-tail, all mangled as she was, crawled up the wall, re-entered the nest, and succeeded in depositing her egg, which she pushed carefully between the pollen and the wall of the cell, so that the bee should not see it on her return.

CHAPTER III.

. ANTS AND DIGGERS.

THE insects which compose the remainder of the Hymenoptera have been arranged by Mr. F. Smith, who has brought to bear upon them an enormous amount of labour and knowledge. His arrangement and definitions will be observed in this work. He divides them primarily into four tribes, the first of which is called HETEROGYNA. These insects are sometimes solitary and sometimes social, the latter being more common than the former. The social species have apparently three, but really only two sexes, namely, perfect males, perfect females, and workers, which are, in fact, partially developed females. The males are always winged, but the females only possess these organs temporarily. As to the solitary species, the females are altogether without wings.

The first division of the tribe is the Aculeata, or sting-bearers. In them, the females have an abdomen consisting of six segments, and furnished with a sting. The antennæ have twelve joints. The antennæ of the males have thirteen joints, and the abdomen has seven segments, but has no sting. In fact, as the sting is a modification of the ovipositor, it follows that no male insect can possess a sting.

We pass to the first family of these insects, the Formicidæ, or Social Ants. In this family the head is more or less triangular, and the basal joint of the antennæ is extremely long, often occupying half the length of the entire organ, and forming a bold elbow at the juncture with the third joint. The eyes are placed at the sides of the head, and do not reach to its top. In the perfect males the ocelli are three in number, set triangularly, and larger than those of the opposite sex. The wings are large and delicate, and only exist in the males and

females, the workers, or neuters, as they are sometimes called, being wingless.

Our first example of this most interesting group is the WOOD-ANT, HORSE-ANT, or HILL-ANT (*Formica rufa*), which is shown on Woodcut XXXIII. Figs. 4, 5, 6, all the figures being magnified. At Fig. 4 is shown the perfect male, at Fig. 6 the perfect female, and at Fig. 5 the imperfect female, neuter, or worker.

These are our largest British ants, the female exceeding a third of an inch in length, and the male being only a little less. The workers are of two sizes, one rather more than a quarter of an inch in length, and the other about the fifth or sixth of an inch. In the female, the head and thorax are rust-red, and the abdomen black. The wings are translucent milky white, with a tinge of brown towards the base. The male is yellowish-black, with red legs, and has wings like those of the female. The larger workers are coloured much like the perfect female, but there is more black about them. The smaller workers are generally darker than their larger sisters of labour.

This is one of the commonest species of British ants, as is evident from the fact that it has three popular names. It is termed Wood-Ant because it prefers woods for its habitation; Horse-Ant, because it is larger than the other species; and Hill-Ant on account of the shape of its nests. These nests are very common in our woods, and especially plentiful in fir-woods, because in them the needle-like leaves of the fir-trees fall in numbers to the ground, and afford material ready prepared for making the hillocks in which are concealed those portions of the habitation which are above ground. Sometimes the ants further protect themselves by taking advantage of a tree which is hollow to the ground, and building their nests within it.

In order to form this external nest, which is often of enormous size, the ants travel to great distances, always following some definite track, which in course of time is plain to the eye, even though all the ants be within their nest. When once these ants have taken to a track, they adhere to it, and many successive generations continue to use it. I have been shown ant-roads by old men, who stated that they have been familiar with them from their earliest recollections. On a fine

day, it is very interesting to watch the Ants travelling backwards and forwards on these roads, some going out to their work, and others returning with bits of stick, blades of grass, small leaves, and other materials for the nest. Some, again, carry in their jaws caterpillars, flies, and other insects for food, and in all cases, whenever a caterpillar or a grub is carried, it is held by one end of the body, so that it projects straight in front of the Ant.

Some Ants are detailed to climb the trees near the path, in search of aphides or other insects, and in many cases, if a tree be examined closely, it will be found to swarm with Ants, even to the ends of the twigs. A smart kick to the trunk of the tree will often bring down quite a shower of Wood Ants, many of them retaining in their jaws the prey which they had captured.

The nest, towards which all their labours tend, is mostly built under some sort of cover, such as a bush or tree, though many nests are totally unconcealed. It consists of two portions, one below the surface of the ground, and the other above it. Though it is made of such fragile materials as small twigs and leaves, which are put together without any cement or without being even interwoven, it is tolerably firm in its structure, and completely riddled with chambers and passages, all communicating with each other. In consequence of the loose architecture of the nest, it is a very difficult business to see its internal economy, the walls of the chambers and passages falling to pieces as soon as the nest is opened, and leaving not a vestige of their presence except the unfortunate inhabitants which they contained.

I have, however, succeeded in obtaining an excellent view into the interior of a Wood Ants' nest, though it was but a short one. Accompanied by my friend Mr. H. J. B. Hancock, I was visiting some remarkably fine Wood Ants' nests near Bagshot. We took with us a large piece of plate-glass, placed it edgewise on the top of an ant-hill, and, standing one at each side, cut the nest completely in two, leaving the glass almost wholly buried in it. After the expiration of a few weeks, during which time the Ants could repair damages, we returned to the spot, and, with a spade, removed one side of the nest as far as the glass, which then served as a window through which

we could look into the nest. It was really a wonderful sight.

The ant-hill was honeycombed into passages and cells, in all of which the inhabitants were hurriedly running about, being alarmed at the unwonted admission of light into their dwellings. In some of the chambers the pupæ were treasured, and these chambers were continually entered by Ants, which picked up the helpless pupæ and carried them to other parts of the nest where the unwelcome light had not shown itself. Unfortunately, this view lasted only a short time. Owing to the partial decomposition of the vegetable substances of which the Ants' nest is made, the interior is always hot and always moist. Now, the day on which we visited the nest happened to be a cold one, and, in consequence, the moisture of the nest was rapidly condensed on the inner surface of the glass, and in a few minutes completely hid the nest from view, leaving me only time to make a rapid sketch. Unfortunately some one discovered the plate of glass and stole it. Next time that I examine a Wood Ants' nest I shall take care to insert the glass exactly east and west, and shall open its southern side towards noon on a hot, sunshiny day, so that the rays of the sun may warm the glass and prevent evaporation.

At the bottom of Plate XI. part of this nest is shown, with the Ants running to and fro and carrying off the white pupæ which are lying in the passages. On the left hand, near the bottom, may be seen that curious little beetle, *Quedius brevis*, which has so strange a habit of living in the nests of this Ant. This beetle has been described on page 75. No less than twenty species of beetles have been found by Dr. Power inhabiting the nest of this Ant. When the nest is disturbed a very pungent vapour arises, not unlike that of strong vinegar, and grievously affects both the eyes and nostrils. This is caused by the formic acid, which is secreted by Ants in great quantities. Indeed, it is so plentiful that in some parts of the world 'ant-vinegar' is made by steeping Ants in boiling water and extracting the formic acid from them.

Mention has been made of the pupæ of the Ant. These are the little, oval, white bodies that are popularly called 'ants' eggs.' The transformations of the Ant tribe are very simple. The larva is fed by the nurses until it is full-grown, when it

sets to work and spins for itself a cocoon in which it is entirely enveloped. The charge of these cocoons falls upon the workers, and admirable nurses they are. They take the greatest care of the cocoons, continually shifting them to higher or lower parts of the nest according to the temperature of the day. If one of these cocoons be opened the insect is found lying inside it, nearly as white as its habitation, and having its limbs tucked against its body. The cocoons are of different sizes, the largest containing those of the perfect males and females, the next size those of the larger workers, and the smallest those of the little workers.

When the perfect insects are developed, they often make their appearance in vast multitudes, and, as they are not able to direct their flight against the wind, are blown about at random just as the breeze happens to turn. Sometimes they fall into the river, where the fish hold high festival over them, and, out of the swarms which leave a nest only a very few survive and found fresh colonies. Indeed, were they all to live, or were even a moderate percentage to survive, the whole country would be eaten up by the Wood Ant alone in a few years. Supposing, however, a pair to have escaped the many dangers of their flight, they disrobe themselves of their wings, and do so, not by tearing them from their insertions, but by simply unhitching them. The wings are thrown well forward, and the insect sharply presses their ends against the ground, when they immediately fall off, and are left lying where they fell, the Ant running away, apparently quite pleased at being rid of its beautiful wings.

THE habits of other British Ants are, on the whole, very much like those of the Wood Ant, though each species has some peculiarity of its own. For example, the BLACK ANT (*Formica fuliginosa*) is remarkable for its sluggish nature, so different from the quick, active fussiness of Ants in general. If a nest of the Black Ant be opened the insects take it very easily, moving gently and quietly as if half-paralysed. However, with all their slowness, they seem to have a very good idea of taking care of themselves, and contrive to slip out of sight, while the more active Yellow or Red Ants would be fussing about, trying one means of escape after another.

Sometimes two entirely distinct species of Ant may be found to occupy different sides of the same hillock, and I have found the Black Ant and the Yellow Ant under the bark of a little fir-stump about seven inches in diameter. Until I took off the bark I was not aware of their existence; and it was a very curious sight to see two distinct colonies in such close proximity, yet neither interfering with the other. Mr. F. Smith mentions that he has found a nest of another ant, *Myrmica lavinodis*, within a hill made by the Wood-Ant. *Myrmica nitidula* has been taken in the same locality.

The RED ANT (*Formica sanguinea*) is worthy of some notice, because it is one of the slave-making species. It invades the nests of other Ants and carries off the pupæ, and transfers them to its own nest. The captors take as much care of them as of their own pupæ; and, when they assume the perfect form, make slaves of them. Mr. Smith mentions no less than four species of Ants which are thus imprisoned and enslaved by the Red Ant. The large workers resemble the females in colour, and vary in length from the third to the fourth of an inch. They are fierce and courageous, and by them the nests of other Ants are stormed and the pupæ carried off as spoils of war. The small worker is rather duller in hue, the crown of the head, the middle of the thorax, and the legs being rather dun than red.

The colour of the female is blood-red, slightly toned down with a very fine ashen dun. The abdomen is reddish-black, and so are the top of the head and the face. The wings resemble those of the Wood Ant. The male resembles that of the Wood Ant, but is redder. This Ant is not very generally distributed throughout England, but is plentiful in some places, such as the New Forest.

THERE is a very singular family of Ants, called *Mutillidæ*, or SOLITARY ANTS, very few of which are known to inhabit England. This is rather curious, because they are very plentiful in most quarters of the globe, and seem equally at home in the hottest and coldest climates. More than three hundred species of the Solitary Ant are in the British Museum, and this number will probably be increased as soon as practical entomologists get to work in various parts of the world which have hitherto

not been explored by them. In these Ants there are no workers or neuters, and the males are always winged and the females without wings. The legs of the female are strong and used for burrowing.

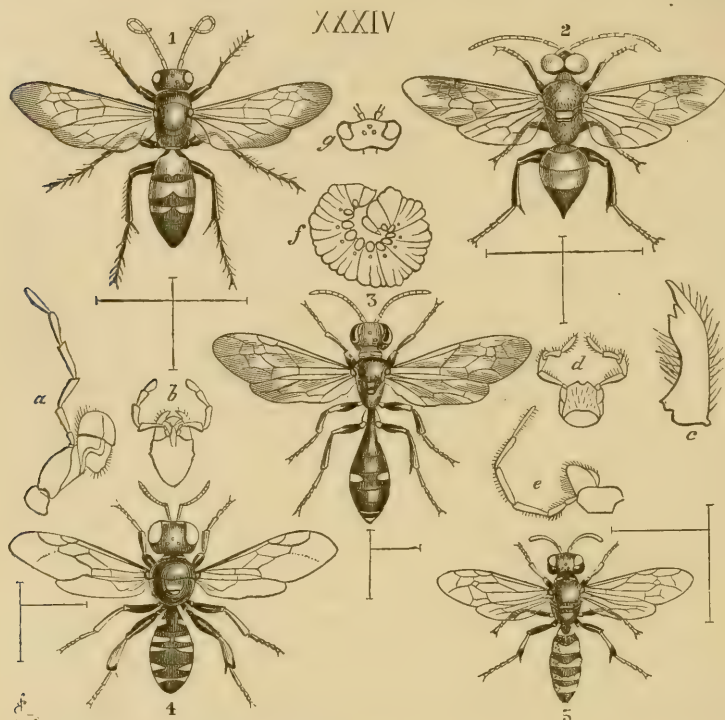
On Woodcut XXXIII. Fig. 2, is shown the female of one of our few species, *Mutilla Europæa*, the male being drawn at Fig. 3. In this insect the principal colours are black and yellow. The head and legs are black, the thorax is rust-red, and the abdomen is shining black, with a band of pale, shining yellow hair on the first, second, and third segments. The legs are black, and covered with hair and bristles. The male is steely-blue rather than black, the thorax is redder than in the female, and the wings are dusky, darkening on the edges towards the tips. This is a scarce, though widely-distributed insect, and has been taken in that very fertile locality, Darenth Wood. It is also found in the New Forest.

It is a parasitic insect, the larva of the *Mutilla* feeding on that of the Humble Bee. In Denmark, out of a nest of Humble Bees containing nearly eighty cells, only two of the legitimate inhabitants were hatched, and seventy-six *Mutillas*, forty-four being males and the remainder females. The *Mutillidæ* are not all parasitic on Humble Bees; as, in countries where Humble Bees are very scarce, the *Mutillidæ* are plentiful; while in England, where the Humble Bees and their nests are so common, the *Mutillidæ* are very scarce.

WE now come to the DIGGERS, and take first the family of *Pompilidæ*, in which the thorax is broad—sometimes broader than it is long, and sometimes slightly squared. The hinder margins are rather angular, the legs are long, and the abdomen is attached to the thorax by a short footstalk. On Woodcut XXXIV. Fig. 1, is shown one of these insects, called *Pompilus fuscus*, slightly enlarged, so as to show better the formation of the wing. In this genus the head is wide, and set transversely on the thorax, and the three ocelli are placed in a triangle on the forehead. The antennæ of the female form a curl at the end, as represented in the illustration, while those of the male are only bent. The front wings have one marginal and three submarginal cells. The hind legs are long, and their claws have a little pad between them. The abdomen is longer in the

female than in the male. At Fig. *a* is shown the maxillary palpus, and at Fig. *b* the labium.

These insects are all burrowers, and vary much in the soil which they prefer for their tunnels. The present species prefers such soil as is found on sandy heaths, and, as it is plentiful all over England, may be captured almost anywhere. The



1. *Pompilus fuscus*. 2. *Astata boëps*. 3. *Mellinus arvensis*. 4. *Crabro quadrimaculatus*. 5. *Cerceris arvensis*. *a*. *Pompilus*, maxilla and palpus. *b*. Do., labium. *c*. *Mellinus*, mandible. *d*. Do., labium. *e*. Do., maxilla and palpus. *f*. *Crabro*, larva. *g*. *Astata*, head of female.

object of the burrow is to form a retreat for its young; and, when the tunnel is formed, the insect lays an egg in it, nearly fills the hole with spiders, and then closes its mouth. The young *Pompilus*, when hatched, begins to feed upon the spiders, and the mother insect is taught by instinct to place in the nest just so many spiders that, when the last is eaten, the larva is ready to change into its pupal state.

All the Pompili are pretty insects. The general colour of this species is slightly shining black. The first three segments of the abdomen are rust-red, each having a narrow black band. The wings are dusky, with a livid blackish band on the tips and lower edges. About twenty British species of *Pompilus* are now known.

In the family *Larridæ*, which comes next in order, the outer edges of the mandibles are curved towards their bases. The tibiæ of the two first pair of legs have one spine at their tips, whereas those of the hind pair of legs have two spines. These may seem to be but trifling characteristics, and yet we shall see their value when we come to define the next family.

ON Woodcut XXXIV. Fig. 2, is drawn an example of this family. Its name is *Astata boöps*, and both names are peculiarly appropriate, as we shall presently see. The head is very large, and wider than the thorax, and the eyes are very large, even in the female, while in the male they are so enormous that they meet on the top of the head, of which they occupy the greater part. The specific name of *boöps*, or ox-eyed, is given to it in consequence of its very large eyes. The figure is that of a male, while the head of the female is shown at Fig. *g*. The antennæ are much more curved in the female than in the male. The first pair of wings have one marginal and three submarginal cells, shaped as may be seen at Fig. 2. The abdomen has a very short footstalk, and in the male the upper surface is flattened. The colour of the insect is black; there is a little grey down in front of the face. The abdomen is black, with the first and second segments rusty-red, as also the base of the third segment. Its edges are somewhat flattened. The wings are nearly transparent, and have a broad blackish band at the tip of the submarginal cell. This is the colouring of the female. The male is usually, though not always, smaller than the female, and the whole face and cheeks—i.e., the part behind the eyes—are covered with shining silvery white down. His eyes are red and the sides of the thorax, the tip and base of the abdomen are covered with long, greyish down.

This is one of the burrowing insects, and is a very active creature, from whence is derived its name of *Astata*, signifying

something that is too restless to stand still. It is a sand-lover, and sand-pits and their neighbourhood are good localities wherein to search for it. Mr. F. Smith states that he has taken it in plenty on Hampstead Heath during the end of July and August. It is not, however, a common species, being one of the many local insects that are plentiful enough in the place which they frequent, but not to be found out of certain limited districts.

The female prefers the hard to the loose sand, and makes therein a tunnel, some four or five inches in depth, stocking it with different insects. According to Mr. Smith the *Astata* generally selects for this purpose the larvæ of one of the field-bugs (*Pentatoma*), but he has seen it carrying a hymenopterous insect, belonging to the genus *Oxybelus*. Only two British species of *Astata* are at present known.

THE family of the Nyssonidæ are easily distinguished from the preceding family by the jaws and the legs. The mandibles are not waved beneath, and all the legs are moderately spined. A rather pretty and very interesting example of this family is given on Woodcut XXXIV. Fig. 3. Its name is *Mellinus arvensis*.

In this genus the head is not wider than the thorax, and the eyes are large and oval. These large eyes are used to some purpose, as we shall presently see. The front pair of wings have one marginal and four submarginal cells, the fourth extending to the tip of the wing. The abdomen is long, and its first segment is so drawn out as to form a sort of footstalk by which it is attached to the abdomen. The colour of the insect is black, diversified with yellow feet, and four yellow bands on the abdomen. It is one of the commonest of its kind, and by the following extract the reader will see how to search for and catch it. Mr. F. Smith gives the following graphic account of the *Mellinus* in his 'Catalogue of British Hymenoptera in the British Museum.'

'Having frequently observed the habits of the type of this genus, *Mellinus arvensis*, and reared it from the larval state, a few observations are here required. When the parent insect has found a burrow of the required length, and enlarged the extremity into a chamber of proper dimensions, she issues forth

in search of the proper food for her young. This consists of various Dipterous insects. Species of various genera are equally adapted to her purpose.

‘It is amusing to see four or five females lie in wait upon a patch of cow-dung until some luckless fly settles on it. When this happens, a cunning and gradual approach is made. A sudden attempt would not succeed, for the fly is the insect of quickest flight, and therefore a degree of artifice is necessary. This is arranged by running past the victim slowly and apparently in an unconcerned manner, until the poor fly is caught unawares and carried off by the Mellinus to its burrow. The first fly being deposited, an egg is laid, the necessary number of flies are soon secured, and her task is completed. Sometimes she is interrupted by rainy weather, and it is some days ere she can store up the quantity required.

‘A larva found feeding became full-fed in ten days; six flies were devoured, the heads, harder parts of the thorax, portions of the abdomen, and the legs, being left untouched. The larva spins a tough, thin, brown, silken cocoon, passes the winter in the larval state, changes to the nymph (or pupa) on the approach of summer, and appears about the beginning of autumn in the perfect state.’

The mandible of this insect is shown at Fig. *c*, the labium at *d*, and the maxilla at *e*. Only two British species of the genus are known.

In consequence of the vast number of British Hymenoptera, we are forced to select a comparatively few examples, taking those which afford the best types of the different families. We now come to the family of the Crabronidæ. In them the head is large, and frequently of very great size in proportion to the body. The shape of the abdomen is extremely variable, sometimes having a foot-stalk and sometimes none; while it may be either oval, elliptical, or club-shaped. The eyes are oval, and sometimes have an impression on one side, which gives them somewhat of a kidney shape.

On Woodcut XXXIV. Fig. 4, is drawn *Crabro quadrimaculatus*, one of the most common of its kind. In consequence of the great number of species in this genus, nearly forty being already known, Mr. F. Smith separates them into several

divisions, the first of which has the abdomen set on a long foot-stalk; the second, in which the abdomen has a moderate foot-stalk; and the third, in which it has a very short foot-stalk, and the ocelli are set in an equilateral triangle. To this division the present species belongs. Its colour is black, variegated with yellow patches, which are variable both in number and size. The clypeus is deeply keeled in the centre, and thinly covered with fine yellowish down. The abdomen has generally four yellow patches—hence the name of *quadrimaculatus*—and one yellow band.

It is a very common species, and makes its burrows in decayed wood. The future larva is supplied with various insects, mostly gnats and other small Diptera. The larva of this insect is shown at Fig. *f*

THE family of the Philanthidæ comes next on our list. In these insects the head is always wider than the thorax. The tibiæ of the middle pair of legs have a single spur at their tips, and the front tarsi are strongly fringed. A good example of this family, *Cerceris arvensis*, is shown on Woodcut XXXIV. Fig. 5. The colour of the insect is black, with the face and thorax mottled with yellow. The female has four yellow bands on the abdomen and the male five, and there is a yellow spot on each side of the first segment. In this genus, the head is squared, and the three ocelli are set in a triangle on the crown. The first pair of wings have one oblong marginal, and three submarginal cells. The first segment of the abdomen is narrowed to half the width of the second, so as to form a sort of footstalk. The legs are strong and the tarsi of the first pair are fringed on the outside.

All the members of this genus are burrowers, and this species prefers hard, flat, and sandy spots. It is, perhaps, the most plentiful of its genus, and Mr. F. Smith remarks that it is more miscellaneous in its choice of food for its young than any other of the burrowing Hymenoptera. It always takes weevils, but, owing to the vast numbers of these beetles, it has a very wide choice. It has been observed to carry off the Nut-weevil (*Balaninus nucum*), and even the Grooved-weevil (*Otiorhynchus sulcatus*). Both of these insects have been described, the former on page 180, and the latter on page 175.

That the latter beetle should be selected for such a purpose is really astonishing. As all entomologists know, its round, hard-shelled body is scarcely pervious to a pin, and, before it can be placed on the setting-board, a needle has to be used in order to pierce the hard elytra and make way for the pin. Yet such an insect as this is actually used as food for the young larva of the *Cerceris*. Mr. Smith remarks that this difficulty is obviated by a peculiarity in the development of the *Cerceris*. The egg is not hatched until some days after it has been deposited, so that the dampness of the soil acts upon the hard exterior of the beetle, and renders it soft enough to be pierced by the jaws of the larva.

The *Cerceris* seems not to be in the least particular as to the species of weevil with which it provisions its nest, but to take any species that may be most plentiful in the neighbourhood of its burrow. The middle of July is the best time in which to search for this beetle.

CHAPTER IV.

WASPS AND SOLITARY BEES.

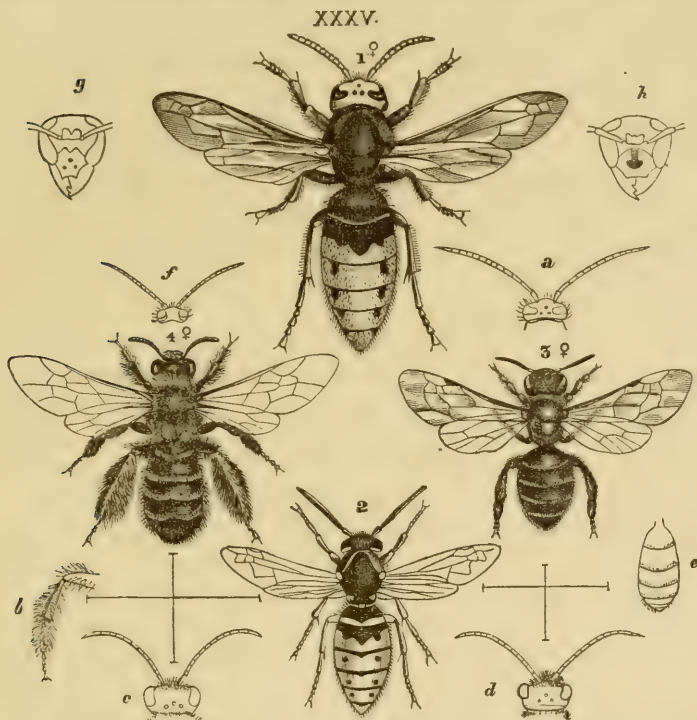
WE now come to the great group called Diploptera, or 'folded wings,' because in repose the second pair of wings are folded longitudinally. In these insects there are Solitary and Social species, and in all the former there are only two sexes, namely, the perfect male and female, while in the latter there is a third, or imperfect or neuter sex, called the Worker. These are, in fact, undeveloped females. All the females, whether perfect or not, are armed with a venomous sting, the construction of which will be described when we come to treat of the Hive Bee. We know these insects popularly by the name of WASPS, and while some species are familiarly known to all who take the least interest in the works of Nature, others, more especially the solitary species, are utterly unknown except to naturalists.

WE will begin with the SOLITARY WASPS, or Eumenidæ, which may be distinguished by the claws of the tarsi, which are double in the Solitary and single in the Social Wasps. On Plate XI. Fig. 1, may be seen two examples of these remarkable insects, one shown in flight, and the other, just below it, engaged in forming its curious nest. The latter specimen, as well as Fig. 3, serves to show the longitudinal folding of the lower pair of wings. The name of this insect is *Eumenes coarctata*, the only British example of its genus.

In this genus the head is triangular, the wings large, with one marginal and three submarginal cells, and the abdomen is somewhat pear-shaped, the first segment being drawn out so as to form a decided footstalk. Its colour is black, variegated with yellow. The front edge of the prothorax and the tibiæ and tarsi are yellow. The segments of the abdomen are edged with yellow, and there are ten spots of the same colour on the

second segment. This is another of the local insects which are tolerably plentiful in their limited districts. Mr. Smith mentions Sandhurst and Sunning Hill as places where it may be found in moderate numbers, and Weybridge as a place where it has occurred sparingly.

This insect is chiefly remarkable for the vase-shaped nest which it constructs from mud. These nests, or cells, are



1. *Vespa crabro*, female. 2. *Vespa vulgaris*, female. 3. *Halictus rubicundus*, female.
4. *Dasyptoda hirtipes*, female. a. *Vespa crabro*, head of male. b. *Dasyptoda*, leg of male.
c. Do., head of male. d. *Halictus*, head of male. e. Do., abdomen of male. f. *Vespa*
crabro, head of male. g. *Vespa arbores*, head. h. *Vespa vulgaris*, head of female.

attached to the twigs of various plants, but especially to the common heath, as is shown on Plate XI. In each of these cells the mother-insect lays a single egg, and then provisions the cell with the larvæ of small Lepidoptera.

BEFORE parting with the Solitary Wasps, of which we have so few British examples, we must mention a very interesting

genus called *Odynerus*, the members of which make their nests in tubes and hollows of various kinds. Some of them are very fond of boring out the pith of dead rose or bramble sticks, making therein a series of cells, and placing in each cell an egg and a supply of food, such as small caterpillars. Two species, *Odynerus lævipes* and *melanocephalus*, adopt this plan, and their curious cells may be found in almost every garden. The former of these insects—a rare species—lines the tube with sand, and constructs the cells of the same material. Some of them, such as *Odynerus quadratus*, burrow into old wood if they can find no hole ready made; but if they can, they make use of it. Mr. F. Smith mentions that he has found its nests in the hollow reeds that formed the thatch of an out-house, and that he has known of a case where it filled with its cells both barrels of a pistol that was hanging to a post in a garden-house. The cells of this species are provisioned with small green caterpillars.

THE next family is that of the Social Wasps, or Vespidæ. There is but one British genus, namely *Vespa*, and eight British species, some of which, such as the Common Wasp and the Hornet, are very well known, while others are almost unknown except to naturalists. All the species build nests of remarkable beauty, some being built under cover, and some being so constructed that they can endure the open air. I once had a beautiful series of nests of British Wasps. The collection included not only the nests, but the nests in various stages of progress, from the first cell to the complete edifice, and each complete nest was accompanied by the male, female, and worker Wasp. The collection was made for me by the late Mr. S. Stone, whose lamented loss deprived the scientific world of a laborious, close, and accurate observer.

In all these nests, however different they may appear externally, there are one or two points in which they agree. The cells are all placed with their mouths downwards, and are arranged side by side in regular tiers, one above another, with just sufficient space between each tier for the Wasps to pass freely. They are all made of a paper-like substance, obtained by tearing off and masticating small fibres of wood, sometimes sound and sometimes decaying wood.

PLATE XI.

ANTS, WASPS, AND SOLITARY BEES.

1. *Formica rufa* and nest.
2. *Quedius brevis*.
3. *Eumenes* and nest.
4. *Vespa arborea* and nest.
5. *Andrena nitida*.
6. *Andrena Trimmerana*.
7. *Cilissa hæmorrhoidalis*.
8. *Nomada ruficornis*.
9. *Stylops melittæ*.

PLANTS:—

Harebell.

Common Heath (*Erica cinerea*), with nest of *Eumenea*.

Ivy.



We will take first the COMMON WASP (*Vespa vulgaris*), which may be seen on Woodcut XXXV., and watch it through the process of making its nest.

In the spring a female Wasp issues from the hiding-place in which she has passed the winter, and begins to search for a suitable locality in which to make her nest. She always chooses for this purpose a hole, such as that of a mouse or rat—generally the former—and, at some distance from the entrance, sweeps away the earth, so as to form a small rounded chamber. Somewhere in the roof of this chamber there is sure to be a root of some kind, and to this root the Wasp attaches a short pillar of papier-maché, somewhere about one-third of an inch in length. At the lower portion of this pillar she forms a small cell, not a sixth of an inch in length, and after a little while places two others at its side. An egg is then deposited in each cell, and the Wasp proceeds to make a roof over them, shaped just like an umbrella.

More cells are now made, more eggs laid, and the first larvæ are hatched, require constant feeding, and grow rapidly, so that, in proportion to their growth, the length of the cell-walls has to be increased. The umbrella-like covering is now too small to serve its purpose, so the Wasp makes a larger one, cutting up and re-masticating the old one. This is always done whenever the nest is enlarged, and it is quite easy to trace the remains of the successive coverings. By this time the larvæ are about to change into the pupal state, and each spins a white silken cocoon over the mouth of its cell, thus shutting itself up from all disturbance. It soon passes through its transformations, and then bites its way through the cell-cover and issues into the nest, a perfect insect, ready to take its share in the enlargement of the nest.

All these early Wasps belong to the workers, and, like the worker-ants, are undeveloped females. They cannot lay eggs, leaving that duty to the original queen, if we may so call her; but they can, and do, collect materials, masticate them into papier-maché, and build fresh cells. They also scoop away the earth from the chamber and enlarge it, so as to fit it for the increasing nest.

By this time the number of worker-wasps has increased so much that a second tier of cells is needed for their energies

to be expended on. Accordingly, they fix a number of papier-maché pillars to the mouths of the cells of the first tier, and to them they suspend a second tier of cells. A third, fourth, and fifth tier follow in rapid succession; and, as the nest is enlarged, so the covering is enlarged in proportion. Sometimes the Common Wasp builds its nest in a hollow tree or in some similar locality; and it is remarkable that the covering of the nest is, in this case, very different from that which is employed when the insect builds an underground habitation. In the latter case the nest is surrounded with layer after layer of paper, so as to protect the cells in case the sides or any of the earthen chambers should collapse; but in the former case the covering is quite thin, and scarcely contains a tenth of the material that is needful for the subterranean nest.

Whatever may be the shape of the nest, the Wasp never leaves the cells without a covering. Knowing this instinct, Mr. Stone induced Wasps to build nests in any form which he liked, simply by arranging pieces of the comb and waiting till the Wasps had covered them. For this purpose he prepared a series of boxes, and actually induced a single swarm of Wasps to build six complete nests, and to begin a seventh. These nests were of all kinds of shapes. One, for example, was like an hour-glass, another like a claret-jug without its handle, another like a stalactite cavern, and so forth. Indeed, when I last saw him, he said that he meant in the following spring to make the Wasps build a nest shaped like St. Paul's cathedral, and I have not the least doubt that he would have succeeded.

Wasps feed chiefly on other insects, though they are very fond of ripe fruit and sugar, and have a fashion of picking out the ripest part of the choicest fruit in a way that is anything but agreeable to the gardener. Flies they eat in great abundance, and, at Walton Hall, I have seen the Wasps flying by hundreds into the pig-sties, and carrying off the flies as they swarmed upon the pigs that were luxuriously basking in the sun. Thus they are not without their usefulness, and, unless they swarm to a great extent, certainly do more good than harm. There are two species of Wasp which are very much alike. These are the Common Wasp (*Vespa vulgaris*), and

the German Wasp (*Vespa germanica*). The latter, however, may be known by three black spots upon the edge of the first segment of the abdomen. In the construction of the nest, the former insect uses decaying, and the latter sound wood. Consequently, the nests of the former insect are of a paler and greyer hue than those of the latter. I have seen a nest which was made by a double swarm of Wasps, one half of each species. The nest was a singularly beautiful one, the grey and warm brown being curiously variegated, according to the portions made by the different species. The nest was preserved by Mr. Stone, and given by him to Mr. F. Smith.

It has already been mentioned that some of the Wasps build their nests in the open air. One of these insects, together with its nest, is drawn on Plate XI. Fig. 3. This is called the TREE-WASP (*Vespa arborea*), because its nests are suspended from the branches of trees and bushes, the Wasp sometimes choosing quite a low bush, and sometimes building in a lofty tree-branch. In this insect, the 'scape,' i.e. the long joint of the antennæ, is yellow in front, in both sexes, and there are three black spots on the clypeus. The nest is very delicately and beautifully made, and, in spite of the apparently fragile nature of its structure, is perfectly able to resist the weather. The nest is suspended by an elongated footstalk, running for nearly an inch parallel with the twig to which the nest is suspended.

Another species, the NORWAY WASP (*Vespa Norvegica*), also builds in trees, and the nest is very similar to that of the former insect. A specimen in my collection shows very plainly the successive coverings that have been made by the mother insect. There are only five cells, and the outer covering has been drawn about half way over that which actually protects the cells. On holding it up to the light and looking at it, the streaks made by the Wasp, while spreading the papery paste, are as plain as those of a painter's brush on the canvas, and the outer covering is so thin that the light can be plainly seen shining through it. Compensation, however, is found for this delicacy by the fact that the several coverings, each standing a little from the other, protect the cells far better than would be the case if there were but one covering, and that a very thick and strong one.

Now we come to the largest and most formidable of the British Wasps, the terrible HORNET (*Vespa crabro*), a figure of which is given on Woodcut XXXV. Fig. 1. This figure represents a perfect female of the natural size. The workers are much less, and, indeed, many worker Hornets are no bigger than the common Wasp, from which, however, they can at once be distinguished by the dark red-brown of their markings.

The nest of the Hornet is exactly similar in character to that of the common Wasp, but the cells are very much larger. The nest is usually made in hollow trees; and within a few hundred yards of my house are several Hornets' nests—a fact which I take care *not* to mention, lest any anxious parent should destroy them, fearing that they might injure his children, a fate that befell one of these nests last year. There is really not the least occasion for fear. The Hornet has a great deal too much to do to spend its time in stinging children, and, unless its nest be attacked, it is peaceable enough. Mr. Stone kept many Hornets' nests at work, and was no more stung by them than a bee-master is stung by his bees. Outhouses and similar places are favourite localities for Hornets' nests.

The successful capture of a Hornets' nest is a very difficult business, and that of a Wasps' is child's play to it. In the first place, it is much more difficult to cut a nest out of a hollow tree than to dig it out of the earth; and in the next place, the Hornet works all night, provided the moon shines, whereas the Wasp stays at home.

The food of the Hornet consists of other insects, and it has a special liking for Wasps. My brother once saw a Hornet in chase of some *Atalanta* butterflies, and the instinct exhibited by the insect was really wonderful. In the open air the short-winged, heavy-bodied Hornet would have no chance of catching the ample-winged butterfly. So the Hornet kept flying backwards and forwards in front of the butterfly, until the *Atalanta* thought to escape by flying through the branches of an elm tree. This was the object of the Hornet's manœuvres, for it at once dashed among the foliage, where the wide wings of the butterfly were at a disadvantage, captured the unfortunate *Atalanta*, bit off its head and wings, and flew away with the body.

THE next tribe of Hymenoptera is that which is called An-

thophila, or Flower-lovers, and sometimes Mellifera, or Honey-bearers. It comprises the insects which are familiarly known as Bees. As is the case with the Wasps, the Bees are both Social and Solitary, and in the former case the workers, or imperfect females, form the majority of the community. The antennæ of the male Bees have thirteen joints, and those of the females only twelve; and the same proportion exists in the rings or segments of the abdomen, the male having seven, and the female only six. The larva is always fed on pollen or honey, or both, this food being stored in cells constructed for the purpose.

All these insects possess a very remarkable modification of the parts of the mouth which are formed with the organ known as the tongue, trunk, or proboscis. The end of the tongue is furnished with a slender brush, formed by tiny hairs which edge the rings of which the organ is composed. Magnified illustrations of the tongues of two kinds of Bee may be seen on Woodcut XXXVII. Figs. *a* and *b*. A very full and detailed description of this organ is given by Mr. Westwood in his admirable 'Introduction,' vol. ii. pp. 256-260. I strongly recommend any of my readers who wish to make themselves adepts in practical entomology, to procure a few specimens of the largest Bees and examine this beautiful apparatus with the aid of a lens. The common Humble-bees will answer the purpose very well. This apparatus is used, as we all know, for extracting from flowers the sweet juices which will become honey after being taken into the system of the insect. The juices in question are not sucked, as they are by the proboscis of a moth or butterfly, but are swept out of the flower by means of the brush.

The first family, called Andrenidæ, comprises the Solitary Bees, and is divided into two groups, namely, the Obtusilingues, or blunt-tongued Bees, and the Acutilingues, or sharp-tongued Bees; the tongues of the former group resembling those of the wasps, while those of the second group are long, lance-shaped, and pointed. Examples of the sharp-tongues will presently be given.

On Woodcut XXXV. Fig. 3, is drawn a Solitary Bee called *Halictus rubicundus*. In this genus the head is rather triangular, and the ocelli are set in a curve upon the crown. The

wings have one marginal and three submarginal cells, the first of which is nearly as long as the other two together. The antennæ of the males are much longer than those of the females. The colour of the present species is black, a very fine dun-coloured brown being upon the face, and a fringe of shining yellow hairs edging the labrum. The middle of the thorax is covered with tawny red down, becoming paler on the sides and towards the base of the thorax. The abdomen is smooth and shining, with a little tawny down at the base. The females have narrow white bands on all the segments, and the males have a similar band on the first four segments only. The shape of the male abdomen is shown at Fig. *e*. The head of the male, with its long antennæ, is drawn at Fig. *d*.

This is a burrowing insect, making a tunnel several inches in depth, and only just large enough to allow of the passage of the Bee. The end of the burrow is slightly enlarged, so as to form a sort of chamber, and in this chamber the Bee places one egg and a quantity of pollen. I have found that the pollen is kneaded together so as to form a hard, paste-like ball, which, by careful digging, can be removed from the burrow without being broken. Nor is this all. From the main shaft, if we may so call it, several short burrows are made, not more than an inch or so in length, and in each of them an egg and a supply of pollen are placed.

Mr. F. Smith has paid great attention to these insects, and has observed that the female Halicti appear early in April and are hard at work until the end of June, when they gradually disappear. About August the male Bees begin to show themselves, soon followed by a quantity of females, who immediately begin to form fresh tunnels. The time occupied in passing through the changes is very short, for in ten or twelve days after the larva is hatched it is ready to pass into the pupal state. It is evident, therefore, that, like the Social Wasps and Bees, the Halicti females hibernate after meeting their mates, so as to begin their nest-making as early as possible in the following year.

There are more than twenty species of this genus, among which, one, called appropriately *Halictus minutissimus*, is remarkable for being the smallest British Bee yet known. The male is barely one-eighth of an inch in length.

NEXT comes the typical genus of the family, two examples of which are given on Plate XI. The genus *Andrena* has the head as wide as the thorax, and, in the male, occasionally wider. The antennæ are elbowed; the wings have one marginal and three submarginal cells, and the hinder tibiæ are furnished with stiff bristles by means of which the insect can carry to its home the pollen which it obtains from flowers. One of these Bees may be seen on Plate XI. Fig. 4. It is called *Andrena nitida*, from the polished and shining abdomen. The colour is black, the thorax being clothed with yellowish down. The nervures of the wings are rust-red, and there is a darkish clouding at their tips. On each side of the second and third segments of the abdomen is a patch of white down, and the tip of the abdomen has a fine dun-coloured fringe.

This pretty species occurs early in spring, and may be found on the flowers of the common dandelion. It makes a burrow very similar to that of the *Halictus*, and, like that insect, forms short accessory burrows radiating from the principal shaft.

ANOTHER species, *Andrena Trimmerana*, is seen on Plate XI. Fig. 5. The colour of this Bee is black, the thorax being covered with a reddish-dun down, and the legs being covered with brownish hairs on their upper surface. The antennæ of the female are longer than is usually the case. One of its burrows is seen, from which it is just emerging. One of the larvæ is shown at Fig. 10.

This insect is common near London, and is worthy of attention as being often infested with the remarkable little beetle called the *Stylops*, which has been described on page 157. At Fig. 5 the *Stylops* may be seen just appearing from beneath one of the segments of the abdomen; and at Fig. 6, at the top of the Plate, the insect is seen as it appears when flying, the peculiar milkiness of the wings being very well given. The species which is most attacked by the *Stylops* is *Andrena convexiuscula*. Out of thirty specimens of this insect, not one had escaped the *Stylops*. It is found in the Isle of Wight and other places, but does not appear to live near London.

Of this enormous genus, nearly seventy species are in the British Museum. Some burrow in loose sand, some in hard ground, and some even prefer very hard, strong paths, over

which there is continual traffic. One species is called by Mr. F. Smith the KENTISH BEE (*Andrena pilipes*), because it is almost peculiar to Kent. It is a very boldly marked Bee. The down on the head and thorax is black, the abdomen is shining, and the hinder tibiæ are silvery white beneath and brown above. I have found it burrowing in a nearly perpendicular sand-bank at Abbey Wood, and reared several of the Bees from their pupa-cells. The tunnels do not run to any great depth, and I was able to cut out the cells with an ordinary pocket-knife. In one year there was quite a colony of the Kentish Bee in that spot. It frequents the thistle; and as it returns to its nest, covered with the white pollen of that flower, it presents a very singular appearance.

JUST above *Andrena nitida*, on Plate XI. and at Fig. 7 is seen another Bee belonging to the same family. Its name is *Cilissa hæmorrhoidalis*.

In this genus the head is transverse, the ocelli are set in a curve upon the crown, and the wings are like those of *Andrena*.

The colour of the present species is black, with a sprinkling of pale down. The face of the male is densely clothed with bright, but pale yellowish down. On the middle of the thorax the down is black, and the rest similar to that of the face. The down on the first joints of the antennæ is pale and on the others is black, with a few yellowish hairs along the sides. The wings are clouded towards their ends. There is a slight difference between the sexes, the female being decidedly larger than the male, and having a line of bright yellowish hair round the thick patch on the thorax, the rest of the down being grey. The fifth and sixth segments of the abdomen are covered with dense golden yellow down.

According to Mr. F. Smith, this is a local insect, and seems to confine itself to places in which the blue-bell grows, that flower being the only one which it frequents. The habits of the insect are exactly like those of *Andrena*. There are only two species known to inhabit England.

THE very beautiful Bee which is shown on Woodcut XXXV. is our last example of the Andrenidæ. It has, I believe, no popular name, but its scientific title is *Dasypoda hirtipes*.

In this genus the ocelli are set in a slight curve on the crown of the head. The upper wings have one marginal and two submarginal cells, the labial palpi have four joints and the maxillary palpi six. Mr. F. Smith calls this 'the most beautiful Bee found in this country; the appearance of the female when loaded with pollen is sufficiently singular to attract the attention of the most apathetic observer.' There is no difficulty in identifying it, as the very long and dense hair of the legs, especially of the hinder pair, is sufficient to indicate it. The general colour is black, but the abdomen has three white bands. The male may be distinguished by his smaller size and brighter colouring. Each segment of the abdomen is reddish yellow at the upper edge, and is fringed with pale yellow down.

It is one of the burrowers, making its tunnels in sand-banks. It does not appear to breed in the immediate neighbourhood of London, but is plentiful in many parts of Kent, especially those in which sand abounds. Sandown, Isle of Wight, is, for that reason, a favourite locality of this beautiful insect. The head and hind legs of the male are seen at Figs. *c* and *d*. Both the scientific names of this insect refer to the exceedingly long hair of the hinder legs. The word 'Dasypoda' is Greek, and signifies 'shaggy-footed,' and the word 'hirtipes' has exactly the same signification in Latin.

WE now come to the Bees or Apidæ. In these insects the tongue is very long, and can be folded under the head and breast when not in use. They are divided into several groups or sub-families, the first of which is called Andrenoides, or Andrena-like Bees. They have similar habits to the Andrena. Only two species of this sub-family are known, both belonging to the genus Panurgus.

AN example of the next sub-family, the Cuculinæ, is given on Plate XI. Fig. 9, and is named *Nomada ruficornis*. The insects belonging to this group are popularly known as Wasp-bees, because, although evidently Bees, they have a very wasp-like look about them, especially in the colouring. They have no pollen-gathering apparatus, neither pollen brushes nor pollen-scales, and are by some authors termed Denudata, or Naked Bees, in consequence of this peculiarity. The reason for the absence of this apparatus is evident enough. Nature never

supplies organs unless they have their work to do, and, as the Bee is a parasitic one, there is no reason why it should take the trouble of gathering pollen. The name of Cuculinæ, or Cuckoo-bees, is given to them in consequence of their parasitic habits.

In this genus the antennæ are elbowed, and are nearly as long as the thorax. The upper wings have one marginal and three submarginal cells. The last segment of the abdomen is blunt in the females and sharp in the males.

This is a most variable insect in point of colour, but it may be generally described as rust-red, with three black longitudinal lines in the thorax, and with yellow spots and bands on the abdomen. There is but little difference in the dimensions of the sexes.

That these Bees are parasitic is well known, but the particular mode of parasitism is scarcely ascertained.

They enter the burrows of certain Solitary Bees, and in those burrows the young *Nomadæ* are matured. It is supposed that when the Solitary Bee has laid in its stock of pollen, the Cuckoo-bee enters the burrow, deposits an egg, and goes off to repeat the process elsewhere. When the real owner of the burrow returns, she finds an egg already laid, takes it for her own, and so goes away and makes a fresh burrow. This, however, is only conjectured, as is the theory that the parasite not only lays an egg, but closes the burrow herself.

One of the most curious points connected with these insects is the fact that the Solitary Bee never interferes with the parasite. Mr. F. Smith has the following remarks on this subject: 'I have on several occasions watched with much enjoyment a large colony of *Eucera longicornis*' (this will be presently described); 'the males occasionally darting forwards with great velocity, then turning sharply round, and as it were swimming in circles close to the ground; then darting off again and again in an unceasing round of sportive enjoyment. Their industrious partners, whose whole existence appears to be bound up in one unceasing round of labour, would occasionally return home laden with food for their young progeny.

'Sometimes it would happen that a *Nomada* had previously entered her nest. When such proved to be the case, she would issue from it, and, flying off to a short distance, wait patiently until the parasite came forth, when she would

re-enter and deposit her burden. It will be observed in this instance, that between *Eucera* and *Nomada* no resemblance exists in general appearance, one being several times larger than the other, and covered with pubescence of a sombre colour; whereas the parasite is a gaily-coloured insect, destitute of pubescence, and readily observed from the brightness of its colouring.'

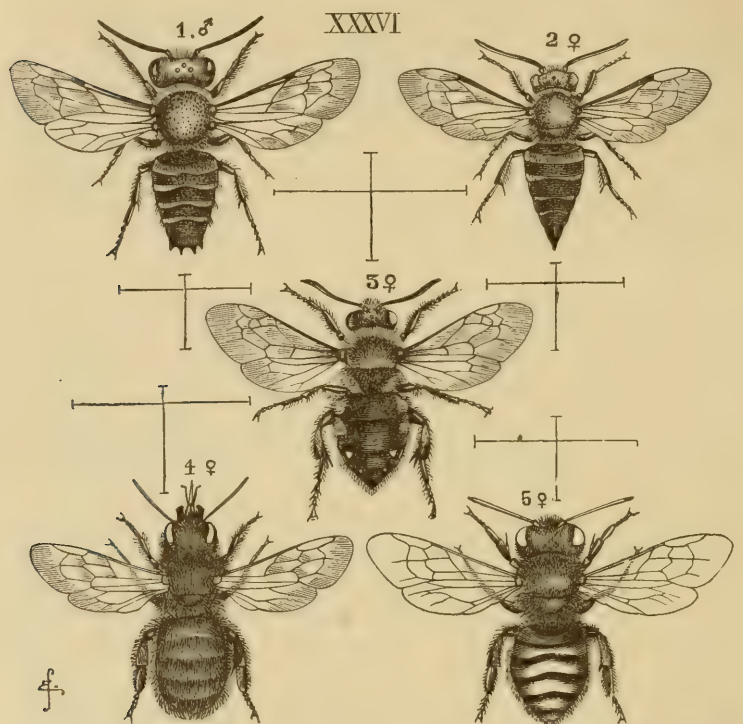
As the result of long, laborious, and minute examination, Mr. Smith is of opinion that the *Nomada* is parasitic upon the food, and not upon the larva of the Solitary Bee, and that when the latter finds an egg in her burrow, she deserts it and goes off to make another. Altogether, twenty-four British species of a *Nomada* are known. The generic name *Nomada* is Greek, and signifies a creature that wanders in search of food and has no fixed home.

ON Woodcut XXXVI. Figs. 1 and 2, are shown both sexes of the parasitic bee called *Cœlioxys simplex*. One of the most striking points in this genus is the strongly marked difference in form of the two sexes. In the female, as seen at Fig. 2, the abdomen is peculiarly sharp, giving occasion for the generic title of *Cœlioxys*, or 'sharp-bellied.' The abdomen of the male, however, is broad, and boldly toothed at the end. The head is as wide as the thorax, and the ocelli are placed upon the crown in a triangular form; the eyes are rather long and hairy. The thorax is rather globular, and the scutellum has a tooth on either side. The upper wings have one marginal and two submarginal cells, as shown in the illustration.

The present species is perhaps the most plentiful of its genus, of which six British species are known, all being parasitic on Solitary Bees. The colour of the insect is black, with a very pale yellowish down on the head and thorax. The wings are dusky, but translucent, and are darker towards their tips. The abdomen is shining black, with a few large punctures. These Cuckoo-bees are often parasitic on the well-known Leaf-cutter Bees, one of which is shown at Fig. 5 of the same Woodcut.

IN the Bee which is drawn on Woodcut XXXVI. Fig. 3, we have an example of parasitism carried out to a curious

extent, as we shall presently see. Its name is *Melecta armata*. The genus to which this Bee belongs has the head transverse, and the ocelli set in a line upon the crown. The upper wings have one marginal and three submarginal cells. There are only two species of *Melecta* known to inhabit England, the present species being the more common of the two.



1. *Coelioxys simplex*, male. 2. Do., female. 3. *Melecta armata*, female. 4. *Osmia rufa*, female. 5. *Megachile centuncularis*, female.

The colour of the insect is variable, but is mostly as follows:—The general colour is black, and the greater part of the body is covered with ashen grey down. There is a tuft of white down on either side of the thorax, and the wings are transparent, but clouded towards their tips. The abdomen is shining black, with the exception of a white patch on either side of the base, another on the second segment, and a very small white spot on each side of the third and fourth segments.

In some specimens the white spots do not appear, so that the insect is entirely black. Both sexes are coloured much in the same manner, with the exception that the whole of the downy clothing has a slight yellowish tinge.

This is a parasitic insect, laying its eggs in the nest of one of the burrowing bees, named *Anthophora acervorum*. This Bee makes its nest in the holes of old walls, chalk-pits, and similar localities, and is a very common insect, absolutely swarming in some localities. It is subject to the attacks of three other insects, which are the common Earwig, the Firetail-fly, already described on page 330, and the Melecta, the two Hymenopterous foes being often seen at once engaged in their destructive work. The Melecta is, however, itself much infested with the larvæ of the Oil-beetle, which may be found clinging to the under side of the thorax.

At Fig. 4, Woodcut XXXVI. is shown an example of one of our most interesting groups of wild Bees, named scientifically *Osmia rufa*. The specimen is a female. In this genus the upper wings have one marginal and two submarginal cells. The ocelli are set in a slight curve on the crown of the head.

The present species is black and hairy. The head of the female is provided with a sort of horn on either side of the face, the ends of the horns being slightly bent inwards. The down on the middle or disc of the thorax is black, becoming dun towards the base, while on the sides and beneath it is ashen grey. The male has no horns on the head, and the face is covered with long white down. The antennæ are long and slender, and the head and thorax, instead of being black, are deep green-blue. The abdomen is covered with thick yellowish down arranged in successive bands or belts.

I mentioned just now that this insect belongs to one of our most interesting groups of Bees. It has always interested me greatly on account of the curious nests which it makes. Generally, one species adheres strictly to one kind of locality, but this is not the case with the *Osmia*, which adapts its cells to various localities, according to the exigencies of the moment. There are ten species of *Osmia*, each having some particular point of interest attached to its mode of nesting.

Take, for example, *Osmia bicolor*. This insect generally makes its cell within the empty shells of garden snails, not because it is unable to make a burrow, but because it finds the empty shells to be as good as ready-made burrows. So it begins by depositing an egg at the end of the whorl, putting in a sufficiency of honey and pollen, and making a partition wall of some vegetable substance. A second chamber is then formed in like manner, and so on until the Bee has reached the mouth of the shell, which it closes with a strong barrier.

There is in the British Museum a very curious example of sagacity in this Bee, showing clearly that the insect possesses some share of reasoning powers as well as mere instinct. She had taken the shell of the large garden snail, and when she came near the mouth, found that it was much too large. So, instead of proceeding after the usual fashion, she has made two cells and placed them side by side, and close to the mouth itself has actually set the cells crosswise.

As, in order to emerge into the air, it is necessary for the inhabitants of the lower cells to pass through the others, this necessity is met in a very simple manner. Those eggs which are laid in the outermost cells produce males, and are developed before the others, so that those insects which inhabit the cells immediately beneath them can pass through their deserted homes.

Another species, *Osmia leucomelana*, burrows in bramble-sticks, not taking out the whole of the pith, but scraping out a series of chambers, which are connected by small passages, so that the walls of division take but little material.

Another species, *Osmia fulviventris*, makes its burrows in decaying wood; while another, *Osmia parietana*—a northern species—chooses the under surface of stones. There is in the British Museum a stone, measuring ten inches by six, on which are no less than two hundred and thirty cells of this Bee. Mr. F. Smith took charge of this mass of cells, and found that the Bees escaped at intervals during three years. 'When found, one-third were developed. The following year a second brood came forth, and while in my possession a third. In the first instance, the whole deposit was subject to the same influences and had produced larvæ; what was the cause of the retarded development of the rest, it were vain to attempt to determine.'

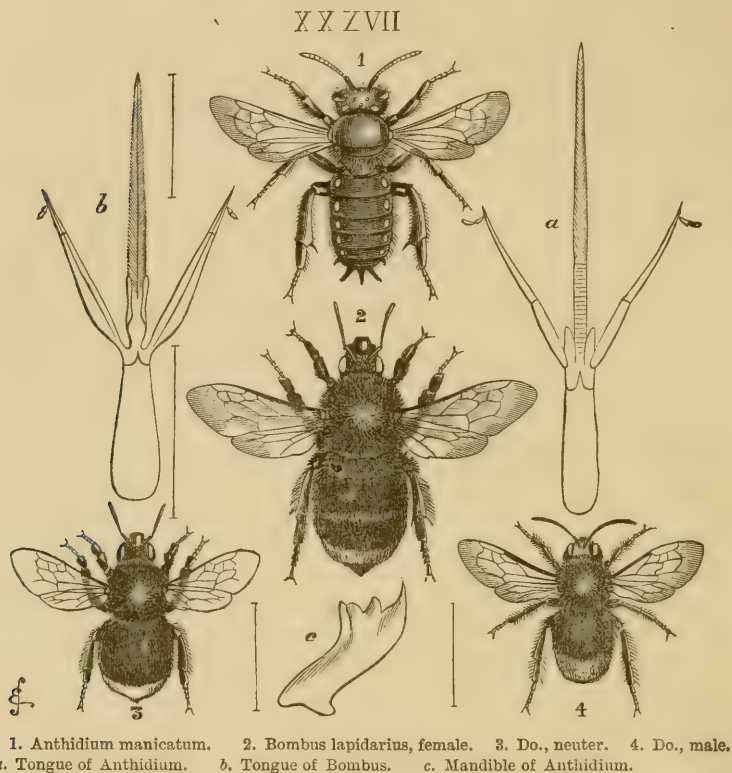
To the next genus belong those curious Bees which are popularly called LEAF-CUTTER BEES, because they line their burrows with pieces of various leaves, those of the rose being the favourites. They burrow in various materials, and sometimes the same species makes its tunnels in decaying wood or in sandstone. The species which is shown on Woodcut XXXVI. Fig. 5, *Megachile centuncularis*, sometimes burrows in decaying wood, sometimes in old walls, and sometimes in the ground.

In this genus the head is large, and the ocelli are set in a triangle on the crown. The upper wings have one marginal and two submarginal cells, and the females have a very thick pollen-brush on the abdomen. This species, which is very plentiful, is black, with ashen grey down, becoming yellowish on the face. The disc of the thorax is nearly naked. The abdomen is heart-shaped in the female, and longer and blunter in the male, and each segment has a very narrow edging of pale yellow down. Beneath, the down is bright golden yellow. It must here be remarked that these colours are only to be found in specimens recently escaped from the pupal cell, the beautiful hues fading by exposure.

ON Woodcut XXXVII. Fig. 1, is a rather magnified figure of the insect called by Gilbert White the HOOP-SHAVER BEE, from a habit which will be presently described. In this genus, of which only one species is known to inhabit England, the head is nearly as wide as the thorax, and the ocelli are set in a triangular form rather forward on the crown. The upper wings have one marginal and two submarginal cells, and the abdomen is rather curved, and furnished in the female with a thick pollen-brush, and in the male with spikes at the end, as seen in the illustration. The present species has five of these spines. Its colour is exceedingly variable in detail, but is generally black, with yellow on the sides of the face and the clypeus. The abdomen has a yellow spot on either side of each segment.

The Bee is a burrower in the decayed wood of willow-trees, but, if possible, she will take advantage of the deserted burrows of the Goat-moth, which will be described in the following pages. In order to prepare a home for its future young, it goes to some down-covered plant, such as the campion, and strips off the woolly covering, running along the stem, and

shaving it quite bare. It then collects the bundle of down between its head and fore-legs, carries it off to the burrow, and with it makes a cocoon-like cell, binding together the fibres of down with some kind of glutinous material. Within this cell it places an egg and a quantity of pollen sufficient to last the young grub throughout its larval condition. When



full-fed, the larva spins within its cell a silken cocoon, from which it emerges in its perfect state somewhere about Mid-summer.

This Bee presents one very remarkable point of difference from insects in general, the male being as much larger than the female as the female is usually larger than the male. The species is quite a common one, especially towards the south of England.

THE Bee which occupies the centre of Plate XII. well deserves its names of *Eucera longicornis*. The former of these two names is Greek, and signifies 'beautiful horns,' while the latter is Latin, and signifies 'long-horned.' Both titles are given to the insect on account of the great length of the antennæ of the male, which are as long as the head, thorax, and body together. These antennæ are very remarkable when viewed through the microscope, the joints being covered with honeycomb-like markings, as if a net with six-sided meshes had been drawn over them. The ocelli are set in a slight curve on the crown of the head, and the upper wings have one marginal and two submarginal cells.

Only one species is known in England. It is black, clothed with a dun-coloured down, changing to very pale yellow on the sides, and ashen grey beneath.

This is one of the burrowing Bees, preferring a hard, clay soil for that purpose. It needs no lining for the cells, but kneads the clay wall of its cell so hard and smooth that it is able to hold the soft paste of pollen and honey with which it is stored. Some of the habits of this insect have been mentioned when treating of the Firetailed-fly (p. 331). Mr. F. Smith has the following remarks on this Bee: 'It does not spin a cocoon, but passes the winter in the larva state, changing about the end of April to the pupa, and shortly after arriving at its perfect condition. The pupa throws off a thin, transparent shroud. The male, on emerging from its cell, passes its long antennæ through the notch at the base of the first joint of the anterior tarsus, drawing the antennæ through, and thus readily divests those organs of the thin pellicle in which they are enveloped. Here we see another beautiful exemplification of the truth that "nothing is made in vain." The long antennæ of the males of this genus are doubtless adapted to some peculiar phase in their economy, and the remarkable hexagonal reticulation of the joints also answers some purpose connected with a peculiar sense the exact functions of which we are unable to appreciate.'

This is not a rare insect, but in some localities is much more plentiful than in others, forming large colonies, and almost honeycombing the earth with its burrows.

CHAPTER V.

SOCIAL BEES.

THE SOCIAL BEES may be roughly divided into two groups, the Wild Bees and the Domesticated Bees. I use the latter terms intentionally in the plural number, because there are several species of Domesticated Bees, two of which are cultivated in this country. We will begin with the Wild Social Bees, popularly known as HUMBLE BEES, HUMMEL BEES, or DUMBLE BEES, the popular name evidently referring to the deep humming sound which they produce when on the wing. In this country the greater part of them constitute one genus, namely *Bombus*, of which we will take some of the most conspicuous insects as examples of the rest.

In this genus of Bees, the body is egg-shaped, and thickly covered with hair. The head is somewhat triangular in form, and the antennæ are slender, elbowed, and a little longer than the head. On the crown there is a semilunar groove or impression, in which the ocelli are placed. The mandibles are stout, and their tips are rounded and grooved. The upper wings have one marginal and three submarginal cells. The females have on the tibia of the hind legs a thick fringe of stiff hairs, which forms a sort of basket for carrying the pollen with which the young are fed. This apparatus is scientifically termed the *corbicula*, or little basket. In the males, the mandibles are fringed with curled hair, and there are no pollen-baskets on the hind legs.

The history of these Bees is at once interesting, simple, and perplexing, and perhaps is the more interesting on account of the extraordinary and apparently contradictory mixture of simplicity and complication. Everyone knows the Humble Bees, but it is not everyone who can say, upon seeing a

Humble Bee, to which species it belongs. Eighteen species of Humble Bee exist in this country, and, except in some of the more prominent species, it is not easy to identify the insects. Varieties in colour and size are almost interminable, especially among the males; and so striking are these varieties, that Mr. F. Smith did not dare to publish his researches on the Humble Bees until he had worked for more than twenty years at them. The result of his labours has been—as is the result of all true labour—simplification. He has found that no less than seven species described by Kirby are but varieties of the Carder Humble Bee, and that six more so-called species are varieties of the Meadow Humble Bee.

OUR first example of these insects is the CARDER BEE (*Bombus muscorum*), so called on account of the curious manner in which it constructs its nest. One of these insects is represented on Plate XII. Fig. 2, in the act of flying, and with its tongue extended. Part of the nest itself is seen below, with one of the inhabitants just entering it.

The colouring and dimensions of this Bee are exceedingly variable, but the following description is that which has been decided upon by Mr. F. Smith:—The Bee is very hairy, and the general colour of the female is black, with the face covered with dull yellow down. The thorax is orange above, yellow on the sides, and grey beneath. The abdomen is more or less banded with black. The male is less than the female, and has the down on the head of pale yellow, becoming blackish on the crown. The abdomen is yellowish-grey, with several ill-defined dark bands. The worker is often barely half the size of the male, and in colour almost exactly resembling the female.

The habits of this species are very interesting. During the winter, a number of females or ‘queens’ lie torpid, as do those of the wasp and hornet, in any convenient crevice that they can find, seldom if ever remaining for that purpose in the nest which they inhabited. Hollow tree-trunks, haystacks, the thatch of barns and outhouses, and similar localities, are much favoured by these females, the intended progenitors of future colonies.

In the spring, the Bees recover consciousness, and at once set to work in searching after fit spots for nest-building. It is

very interesting to watch a Carder Bee thus engaged. In the early part of the present year, I watched for nearly an hour the proceedings of a Carder Bee, who fortunately restricted herself to a small patch of ground. The soil is very light, partly covered with ferns, and on it are one or two oak trees, one of large size. There is also plenty of moss within a few yards, so that the locality is a very favourable one. As long as she was on the wing I had to be very quiet, as she would have taken alarm at a sudden movement, but whenever she settled I was able to approach her quite closely. She investigated almost every inch of ground, trying it in all directions, and apparently testing the character of the soil by scratching it with her feet. At last, she evidently fixed upon a convenient spot—a small hollow in the ground near the roots of an oak.

She was so absorbed in her work, that I was able to kneel down and watch her through a magnifying glass without disturbing her. At last, I thought I would try a small practical joke, and built over her a small hut of twigs and leaves. She was still so preoccupied that she took no notice, until I pushed her gently with a grass stem through the interstices of the hut. This treatment roused her from her abstraction, and she bounced up against the roof of the miniature hut in great perturbation, at last forcing her way through it, and going off at full speed and with an angry hum.

When the Bee has fixed upon a suitable spot, she procures some vegetable substance, generally moss, but sometimes dead leaves, grass, fern-fronds, &c., and draws them through her legs, much as wool is carded. With these materials she builds a sort of low dome, so arranged as to harmonise with surrounding objects, and look like a mere swelling of the ground. Mr. F. Smith mentions an instance in which the Bee flew into a stable, and carried off a quantity of horsehair, which she wove into a nest as if it had been moss. In order to preserve the interior from rain, she lines the dome with a coarse wax, similar in nature, though not in quality, to that of the Hive Bee, and under its protection she makes a series of cells. These cells are not in the least like the delicate, sharply defined, hexagonal cells of the Hive Bee, but are oval, and distributed almost at random.

In them are laid the eggs which at first produce worker Bees, they being needful in order to help the Queen Bee in

PLATE XII.

HUMBLE BEES.

1. *Bombus lucorum* (Female).
2. *Bombus muscorum* (Female).
3. *Apathus vestalis* (Female).
4. *Eucera longicornis* (Male).

PLANTS :—

Hawthorn. Above.

Sea Campion (*Silene maritima*). Below.



forming a large colony. The larvæ soon become full-fed, and then spin a silken cocoon, in which they pass their helpless state. When they have attained the perfect condition, they gnaw round the top of their cocoons, and escape by means of the circular orifice. When they first emerge, their colours are very ill-defined, and several days elapse before the long down with which they are so profusely clothed changes to its varied and beautiful colouring.

On Plate XII. Fig. 1, is shown another well-known species of Humble Bee, with her nest. This is the WOOD HUMBLE BEE (*Bombus lucorum*). The colour of this Bee is black, with the front of the thorax and the second segment of the abdomen yellow, and the end of the body white. The worker is scarcely half the size of the perfect female, but is coloured after the same fashion. The male is intermediate in size, and has the face, the front of the thorax, the scutellum, and the two first segments of the abdomen yellow, and the three last segments of the belly white. Beneath it is yellowish-white, and on the tibiæ is a fringe of yellow hairs.

This is one of the earliest of the Humble Bees in appearing, and is generally spread over the kingdom. Like one or two other species, it makes its nest underground, and is rather a ferocious sort of Bee, resenting even an approach to its nest, and using its large sting very freely. Many persons have an idea that Humble Bees cannot sting, an idea that is probably originated from the fact that at certain times of the year the male Bees, which have no sting, are rather more plentiful than the females.

Not that they are more numerous, but that we see more of them, because the male Bees have no hard duties to perform at home. They collect no honey nor pollen, they secrete no wax, they build no cells, and they nurse no young. Those Bees within the nest are almost invariably females, while those which roam about at their ease from flower to flower are very often males, and consequently cannot sting their captors. If anyone doubts whether the female Humble Bees have stings, let him attack the nest of any of the underground species, particularly that of the Stone Humble Bee, and he will be speedily convinced of his error. I have taken the nest of most of the British Humble

Bees, and can testify that, whereas the females of the Carder Bees take such attacks quietly, and seldom use their stings, those species which build underground resent the assault, and very soon let their assailants know that they have stings and can use them.

The Plate gives a very good idea of the Wood Humble Bee's nest, and of the shape and position of the cells. The wax of which they are made is coarse and brown, and the walls of the cells are of considerable thickness. They are of various sizes, according as they are intended to serve as the habitations of females, males, or workers. Some contain honey, which is usually of a pinker hue than that of the Hive Bee, and is peculiarly sweet and fragrant. It is, however, seldom fit for food, as it gives a violent headache to most persons, myself among the number. I have suffered severely from a hard, throbbing headache, caused by eating scarcely a teaspoonful of this insect's honey, before I found out its evil qualities. It is a pity that the honey should have such an effect, for it is far superior in flavour to that of the Hive Bee, having a sort of delicate perfume about it.

The size as well as the position of the nest differs greatly. Sometimes there are but a few cells, and sometimes the colony is so strong that there are about two hundred cells in the nest. The depth in the ground also varies, much as does that of the common wasp, and for the same reason. The Humble Bee very seldom, if ever, makes the whole of the excavation in which her nest is placed, but takes advantage of a deserted mouse-hole, and scoops out the earth wherever she finds it most convenient.

ANOTHER species, the Stone Humble Bee (*Bombus lapidarius*), is drawn on Woodcut XXXVII. Figs. 2, 3, and 4. At Fig. 2 is shown the perfect female, or Queen Bee; 3 is the imperfect female, or worker, and 4 the male, these figures being of the average size of the sexes. This is the 'red-hipped Humble Bee' of Shakspeare, and is a very familiar insect. The female is black, with the three last segments of the abdomen bright rusty-red. The worker is coloured like the female, and the male is black, with yellow down on the face, top of the head, and collar. Yellow hairs are also

scattered on the scutellum and first segment of the abdomen, the four last segments of which are red.

This is a very common species, and derives its name of *lapidarius* from the fact that it always, if possible, constructs its nest under stones. Those heaps of rough stones which are often left for several years on the sides of country roads are favoured habitations of this Bee, which seems to consider that not only the particular stone-heap which it has chosen, but also a considerable surrounding space, is its own property. In most cases, the attacks of the Bees are so fierce that anyone who is tempted to linger near the heap finds himself obliged to remove at once from the vicinity of these irritable insects.

It does not, however, absolutely restrict itself to such habitations, for stone-heaps are not to be found everywhere, and so it has to put up with burrows in the ground, preferring such places as banks and the roots of trees.

On the upper part of Plate XII. Fig. 3, is represented a very remarkable insect. At first sight, anyone would say that it was a Humble Bee; and, as the insect may be found in Humble Bees' nests, it may well be ranked among their number. Yet, as we shall presently see, it must not be reckoned among these insects, and, though with them, it is scarcely of them.

The genus *Apathus* very much resembles *Bombus* in its characteristics. But it has no pollen-baskets in the female, the tibia of the male is convex on the outside, and there is no worker. The absence of the pollen-basket in the female and the convexity of the hind tibiæ in the male are the most striking points of difference.

We naturally ask ourselves, why the *Apathus* does not possess the pollen-basket. The reason is, that it does not require it. It does not work, but subsists on the labour of others, and that in a very curious manner. As a general rule, the presence of parasites in a nest is exceedingly troublesome to the rightful inmates, who resent with all their power the presence of the intruder. This, however, is not the case with the *Apathus*.

Mr. F. Smith, who has paid great attention to this curious subject, and has thoroughly tested and investigated the researches of Kirby, the original discoverer of the distinction

between the *Apathus* and the Humble Bee, has the following remarks on these insects:—

‘Although the parasitic connection between these and the true *Bombi* has long been conjectured, no author has hitherto found them in the nests of the working species. Although I have taken or examined a very large number of the nests of *Bombus*, I have only occasionally met with the parasites in them; but never in the nests of the brown Humble Bees. . . .

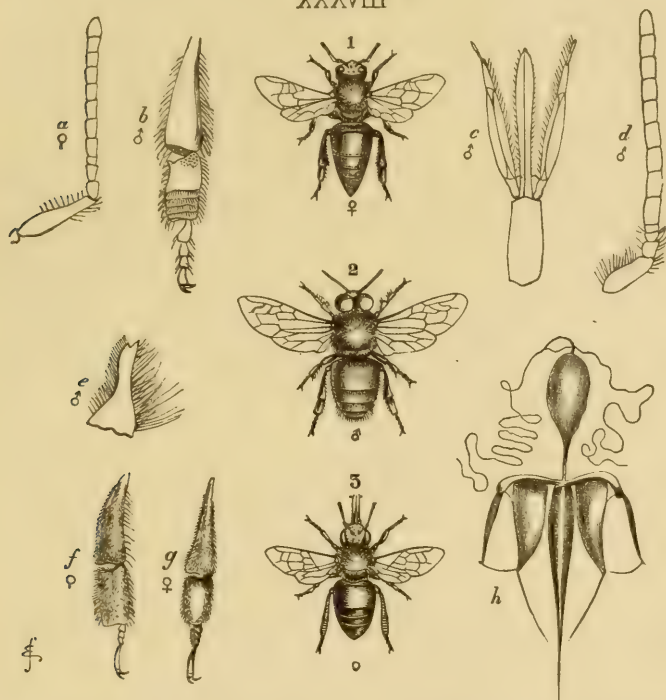
‘What office these Bees perform in the economy of the nest has not been discovered. They live on the most friendly terms with the industrious part of the community, and it is probable that upon them devolves some important office, the nature of which it would be very interesting to discover. It has been supposed, from the very close resemblance of the *Apathi* to the *Bombi*, that the former are an idle race reared at the expense of the industrious Bees, and wearing a livery in imitation of them, for the purpose of deception. But, there can be little doubt of these aristocrats of the community performing important and necessary duties highly conducive to the general prosperity of the whole. That the close resemblance of these Bees is not for the purpose of deception is at once proved by the fact of *Apathus barbatellus*, a yellow-bearded Bee, being found in the nest of *Bombus Derhamellus*, a black species, having the tip of the body red; and we have already seen that amongst the solitary Bees the greatest difference in appearance exists.’

The colour of this species is black, with a broad orange band in front of the thorax. The abdomen is shining and less covered with down than is the case with the true Humble Bees. There is a little white down on the sides of the third segment, followed by yellowish down on the fourth and fifth, and the sixth has a little reddish tuft at the tip. This is the colouring of the female. That of the male is somewhat similar but brighter, the wings are slightly clouded at their tips, and there is some yellow down on the scutellum and the first segment of the abdomen. The insect is quite a common one, and is parasitic in the nest of the Common Humble Bee (*Bombus terrestris*).

THE whole of Woodcut XXXVIII. is devoted to one insect,

the common HIVE BEE (*Apis mellifica*). The three sexes are shown at Figs. 1, 2, and 3. Fig. 1 represents the perfect female, or 'queen,' of which there are very few in one community, and only one that is active. Fig. 2 is the male or 'drone' Bee, of which a considerable number exist for a limited period, and Fig. 3 is the worker, of which the population of the community is chiefly composed.

XXXVIII



1. *Apis mellifica*, female. 2. Do., male. 3. Do., neuter. a. Antenna, female.
 b. Hind leg, male. c. Tongue of male. d. Antenna, male. e. Mandible, male.
 f. Hind leg, neuter. g. Hind leg, female. h. Sting and venom glands.

In this genus the eyes of the male are very large, meeting on the crown, as may be seen at Fig. 2, and the tibiae of the hind legs are slender at the base, gradually widening to the end, as shown at Fig. b. The eyes of the female and worker are comparatively small and unhairy. The workers have the basal joint of the tarsi of the hind legs concave, and covered with transverse hairy ridges, as shown at Fig. f. That of the

perfect female, or queen, is smooth, as shown at *g*. The antennæ, too, are different in the sexes, as may be seen by referring to Figs. *a* and *d*, the former representing the antenna of the female, and *d* that of the male.

I may mention here that the little hieroglyphic marks attached to the figures on this and a few other woodcuts denote the sex. They are, in fact, the old astronomical figures used to denote the planets by a sort of short-hand. The circle with the barbed point was used as the emblem of Mars, and is employed by naturalists to denote the male sex. The circle with the crossed line below it was the emblem of Venus, and denotes the female sex, while the circle with the uncrossed line denotes the imperfect female, or neuter.

A detailed account of this wonderful insect would be absolutely impossible within the limited space at our command, inasmuch as the whole volume would be consumed in such an undertaking. I will, therefore, only mention a few of the more salient points connected with the economy of the Hive Bees, and leave the reader to look for further information into the many excellent works which have been written expressly on this subject by men practically skilled in bee-keeping.

The constitution of the community, or, as we popularly call it, the hive, differs from that of other social insects.

There is but one perfect female permitted to live within the hive, her duty being a very simple one—namely, to lay the enormous number of eggs from which proceed the future swarms. She never leaves the hive except when she issues into the air to find a mate, and she does no work of any kind, not even requiring to feed herself. In form she is somewhat longer than the worker, and, though, when young, she is scarcely different from the worker in size, she may be recognised by the shortness of her wings, and the manner in which they cross each other at the tips as they lie at rest on her back. Her whereabouts in the hive can soon be detected by a practised eye, as there is always a cluster of Bees around her, with their heads towards their sovereign. They behave as politely as any modern courtier. Wherever she goes they go too, but they never turn their backs on her, always keeping a small space clear round her, just large enough to enable her to

walk, and advancing, retreating, or sidling as she happens to move.

The males, or drones, are comparatively numerous. They can be at once recognised by their greater thickness, and the blunt abdomen with its little tufts of hair. Even on the wing the drone Bee can be distinguished by its low, dull, deep hum. It seems to be much more sluggish in its ways than the worker. Some years ago, when I was engaged in reproducing the dissections of John Hunter, I supplied myself with drone Bees, by watching the entrance of the hive, and taking the drones off the foot-board as they came out of the hive. They seldom troubled themselves to make any effort at escape, and I could take as many as I liked without even arousing the anger of the workers.

As to the workers themselves, they are so familiar that nothing need be said about their appearance.

The construction of the nest differs from that of any other insect, though it bears a great resemblance to that of the wasp or the hornet. The cells are hexagonal, but are made of wax instead of paper. They are double, being set end to end, or rather, base to base, and lie nearly horizontally, instead of perpendicularly as in the wasp tribe. We will glance at each of these points, and will first take the material of which the nest or 'comb' is made.

This, as we all know, is wax, and, as most of us know, is secreted by the Bee, and not gathered from flowers, as was formerly thought to be the case. When the Bees are about to build a new comb they hang in strings, holding by each other's feet, and remain in that position for a considerable time, perfectly still. If, at the expiration of that period, the under side of the insect be examined, six tiny white crescents will be seen. These crescents are the edges of the wax plates, which project from beneath the little flaps called 'wax-pockets.' With the exercise of a little care, the plates of wax may be removed from the pockets, and put up as specimens. Much care, however, must be taken of them, as I have learned by experience. I had, with some trouble, secured the six plates of a single Bee, and had arranged them in their order upon a slip of dark-blue paper, which was carefully inserted into a bottle. One bright summer day, a visitor was examining the series of bee-

dissections, and was particularly pleased with the wax plates. He took the bottle to the window to examine the plates more easily, held the bottle in the hot rays of the sun, and melted the six plates into six formless waxen drops.

A sufficient quantity of wax being obtained, the Bees set to work at kneading it with their jaws, and continue to do so until they have made it quite plastic. They then begin their labours, and, urged by an instinct which is quite beyond our comprehension, construct with this substance a double set of perfectly hexagonal cells, which practically illustrate the problem of constructing a vessel which shall consume the minimum of material and hold the maximum of contents. The mathematical problems involved in the structure of the bee-cell are most interesting, but there is not sufficient space at our command. I would, therefore, refer the reader to my 'Homes without Hands,' page 428, in which these problems are given in detail. Suffice it to say that the key to the structure of the bee-cell lies in the angles of the three equal lozenge-shaped plates which form the base of the cell.

If the reader will examine a fresh bee-comb he will see that the edges of the cells are much thickened and rounded, besides being rather darker and redder than the wax which forms the sides. The material with which this is done is termed 'propolis,' and is a gummy substance obtained by the Bees from certain trees, among which the horse-chestnut is conspicuous. Everyone is familiar with the sticky substance that coats the buds of this tree, and guards them from the weather. This is the principal source of the propolis, and the Bees may be seen continually scraping off and carrying home this material, which they use as a cement as well as a strengthening edging to the cells.

Still looking at the comb, the reader will see that the cells are not quite horizontal, but that they slope slightly from mouth to base. The object of this slope is that they shall the more easily receive the honey which is stored in them, and which is, when first placed in the cells, nearly as transparent and liquid as water. In fact, it is much of the consistency of *eau sucrée*. Honey is a really peculiar substance. It is not obtained ready-made from the flowers, and simply transferred to the cells.

The sweet juice of the flower is indeed to honey much what grape-juice is to wine. It is licked out of the flowers by the brush-tipped tongue of the Bee, and then passed into the honey-bag, a nearly spherical membranous sac, situated at the base of the abdomen, close to the short footstalk which conjoins the thorax and abdomen. Within this sac it undergoes the change which converts it from a mere saccharine juice into honey. What that change is we do not precisely know, nor how it is achieved, for the honey-bag appears to be nothing more than a membranous sac. Still, some change, and that a great one, is made, as is evident from the fact that if the Bees be supplied with sugar and water they make honey from it. Despite this change, however, the honey always retains something of the flavour belonging to the flower whence it was obtained, together with some of its properties; so that there have been instances where those who have eaten honey have been nearly poisoned by it, the Bees having made it from plants which possessed poisonous qualities. That which is made from heather is generally thought to be the best and purest. We may, perhaps, ask ourselves why the Bee should take the trouble of making so many cells wherein to store the honey, instead of putting it into one or two larger vessels. The reason is that when honey is taken out of the cells, and placed in larger vessels, it soon crystallises, and in that state is even injurious to the Bees, whereas it can be kept perfectly fluid while in the small and tightly-closed cells.

The 'bee-bread,' on which the young Bees are fed, is made from the pollen of various plants pressed tightly into the cells. If a cell full of bee-bread be cut longitudinally, each cargo of the Bee can be discerned, some eight or ten journeys being required to procure a sufficiency of pollen to fill up the cell; and the pollen of each cargo being generally marked by a slight difference of colour.

Some six or seven species of Bee are domesticated in different parts of the world, and Mr. Westwood suggests that there are many other species which might with advantage be brought to subserve the purposes of man. The structure of the sting is shown on Woodcut XXXVIII. Fig. *h*. This well-known weapon is in fact a modification of the ovipositor, with the addition of a poisonous liquid. This liquid is secreted by two

very delicate poison-glands, which resemble threads, not nearly so thick as a human hair, and white in colour. These glands unite together at their bases and form a short common tube, which opens into the poison sac, in which the venom is retained until it is wanted. The base of the sting is connected with the poison sac, and as soon as the weapon is used, the poison flows down the sting and is injected into the wound.

LEPIDOPTERA.

LEPIDOPTERA.

CHAPTER I.

RHOPALOCERA, OR BUTTERFLIES.

I VERY much regret the necessity for using such words as that which appears at the head of this chapter. I employ such words as seldom as possible, and always explain them when compelled to use them, as is the case at present. Still, in many instances, scientific terms are absolutely necessary, because there are no existing English words which have the same signification, and, in many others, even though there may be English equivalents, the scientific terms are so universally employed that it is necessary to introduce them and explain their meaning.

To begin with the word Lepidoptera. It is formed from two Greek words, the one signifying a scale, and the other a wing, and is given to those insects because their wings are, for the most part, covered on both sides with flat scales which overlap each other just like the tiles of a house. This is the most important characteristic of the order, but there are one or two others which must be noticed. The mouth is formed for suction. The mandibles, or jaws, which are so conspicuous in the insects which we have hitherto examined, and which indeed are large and powerful in the larval state, are scarcely visible, being reduced to mere rudiments of jaws. The maxillæ, on the contrary, are very much elongated, and modified into the beautiful proboscis through which the insect is able to suck the sweet juices of flowers. The pupa is enclosed in a hard, shelly case, not resembling the perfect insect, this form being scientifically called 'obtect.'

The Lepidoptera fall naturally into two great divisions or

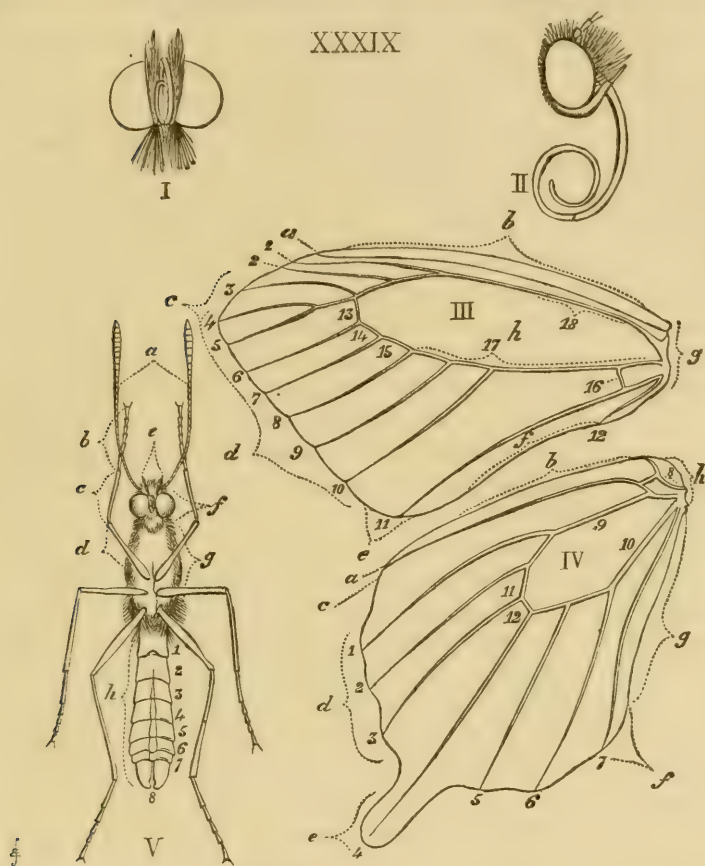
sections, known popularly as BUTTERFLIES and MOTHS. We will begin with the Butterflies.

These insects are, as may be seen by reference to the beginning of the chapter, called *Rhopalocera*. This term is formed from two Greek words, the one signifying a club and the other a horn, and is given to the Butterflies because, as a rule, their antennæ are clubbed, or knobbed, at the end. As far as English *Lepidoptera* are concerned, there is no difficulty whatever in distinguishing between them and the Moths, the latter always having their antennæ pointed instead of clubbed at the tip. Butterflies, moreover, cannot fold their antennæ to the body as is done by many of the Moths, those organs always standing out boldly from the head.

Then, the head itself is very distinct from the thorax, and is never sunk into it, as is the case with so many insects, but is attached by a slender neck. The compound eyes possessed by Butterflies are remarkable for the astonishing number of facets which they possess, some of them having sixteen thousand facets on each side, or thirty-two thousand in all. The wings, too, serve to distinguish Butterflies and Moths. The latter insects often have the hind, or second, pair of wings folded longitudinally, but those of the Butterflies are quite rigid and incapable of being folded. When the insect is at rest both pairs of wings are raised over the back, and mostly pressed closely together. This attitude is often employed as a means of avoiding detection, for the Butterfly, when its wings are thus closed, has very much the air of a leaf or a flower petal, and so escapes observation. The splendid and conspicuous Red Admiral and Peacock Butterflies frequently elude the eye in this manner.

FOLLOWING the plan which I have adopted throughout this work, I now give a map or chart of a Butterfly, showing the principal portions of the insect, and the distinctive names attached to them by entomologists. Some of these words look rather formidable, but there is really little difficulty in learning and retaining them; and the best way of learning them is, to trace them out on the wings of various Butterflies, and, if possible, to sketch those wings on an enlarged scale, and write the names of the different portions. The principal portions of

the wings are those which are denoted by letters, and which should therefore be learned first; the knowledge of the other



I. Front view of head. II. Side view.

III. Fore wing. 1-5. Subcostal nervules. 6, 7. Discoidal nervules. 8-10. Median nervules. 11. Submedian nervure. 12. Internal nervure. 13-15. Disco-cellular nervules. 16. Interno-median nervule. 17. Median nervure. 18. Subcostal nervure. a. Costal nervure. b. Costa or anterior margin. c. Apex or anterior angle. d. Posterior or hind margin. e. Posterior or anal angle. f. Interior or inner margin. g. Base. h. Discoidal cell.

IV. Hind wing. 1, 2. Subcostal nervules. 3. Discoidal nervule. 4-6. Median nervules. 7. Submedian nervure. 8. Precostal nervure. 9. Subcostal nervure. 10. Median nervure. 11, 12. Disco-cellular nervules. a. Costal nervure. b. Costa or anterior margin. c. Apex or anterior angle. d. Hind margin. e. Tail or caudal appendage. f. Anal angle. g. Abdominal or inner margin. h. Base.

V. Underside of body. 1-7. Abdominal segments. 8. Caudal or anal extremity. a. Antennæ. b. Tarsus. c. Tibia. d. Femur. e. Palpi. f. The head. g. The thorax. h. Abdomen.

portions being gained by degrees. Here I may mention that Mr. E. Newman repudiates the word nervure, and substitutes

the simpler word 'ray,' as analogous with the fin-rays of fishes. He is undoubtedly justified in considering that 'ray' is the better word, but as in all scientific accounts of the Lepidoptera the word 'nervure' is used, I have employed it, leaving the reader to substitute the word 'ray' if he should prefer it.

The reader will notice the enormous size of the eye-masses, as shown in Fig. 1, this great size and bold projection being rendered necessary by the fact that these insects are all day-fliers, perpetually on the wing, and, consequently, very conspicuous. Now, there are many creatures—certain birds, for example, dragon-flies, and other predacious foes—which are very fond of Butterflies, and would wofully thin their numbers did not their multitudinous eyes enable them to see the approaching enemy in time for their broad wings to carry them out of danger. The form of the proboscis is also shown in Figs. 1 and 2, the former representing it as it appears when coiled up so as to be out of harm's way, and the latter showing it as partly uncoiled, as it appears when the insect is about to take food.

WE now proceed to take in their order some typical examples of British Butterflies. The first family is called Papilionidæ, and may be distinguished by having the first pair of legs formed for walking, the tip of the antennæ not hooked, and the discoidal cell of the hind wings quite closed. Only one genus inhabits this country, and only one species, the beautiful SWALLOW-TAIL Butterfly (*Papilio Machaon*), which is shown in the frontispiece.

In the genus to which this Butterfly belongs, the hind wings are tailed, and the caterpillar, or larva, is furnished with a forked appendage called the 'nuchal horn' because it issues from the neck. In this species the horn is only used in moments of irritation, and is concealed within the body, its place being only marked by two dots. If, however, the caterpillar be irritated or hurt, it immediately throws out the horn, which can be produced to the length of half an inch or so. Many naturalists suppose that this horn is intended for the purpose of driving away the ichneumon flies when they attack the larva. I can, however, scarcely accept this theory, because the ichneumon flies are terribly injurious to many other cater-

pillars, which yet are supplied with no apparatus for driving them away. This organ, whatever purpose it may subserve, gives forth a very strong odour, much resembling that of fennel, and so powerful that even in the open air it can be perceived at some distance.

The colour of this splendid Butterfly is almost entirely yellow and black. On the lower wings, however, there is a row of six cloudy blue spots, sprinkled with yellow dots, and at the anal angle of each lower wing is a large red spot with a slight blue crescent on the upper part. This Butterfly was once spread over a considerable part of England, but now seems to be restricted to the marshy parts of Cambridge, Huntingdon, and Norfolk. It has been taken in many other places, but I believe that in all those instances it was not native to the place, but had been artificially introduced. I once saw a specimen in a field by the Cherwell, close to Oxford, and chased it for some time, but unsuccessfully. Whether or not this was an introduced specimen, I have no means of ascertaining.

I was never fortunate enough to have a day's Machaon-hunting, but my friend, Mr. D. J. French, has sent me an account of a very successful day's hunt:—

‘Saturday, July 10, 1871, will always be a red-letter day in my annals of natural history.

‘My brother and I drove off, amid the rain-like mist, along one of those everlastingly flat Cambridge roads, till we sighted the whitewashed front of the old public, with the conspicuous sign of “Five miles from anywhere.” In a few minutes more we were over the ferry, and stepping off to the fens with somewhat hopeful feelings, for the sun was peeping out. The ditch was soon cleared by the help of the jumping-pole, kept at the aforesaid inn for the use of entomologists. My brother was over first, and before I could follow a hearty shout informed me that a Swallow-tail was captured. In less than three minutes, at 1.5 P.M., three hurrahs rang through the fens, as I beheld, for the first time in my life, a self-captured *Papilio Machaon* within my net. Oh, ’twas a pleasant sight to see!

‘The next two hours were exciting ones indeed, for no sooner had I pinned an insect than another was seen. Although ready to drop through the heavy chase just completed, off we dashed, disturbing from their nests and passing unheeded

whinchats, stonechats, whitethroats, and other sedge and grass-loving birds. A swift foot soon brought the aerial object near; then came the sudden switch and the simultaneous drop—a sign that all was right. The fall into a sitting posture was the natural, necessitous, and happily convenient move, for directly the capture was made our legs lost all power, and suggested a seat on the fen as the right position for pinning the prize; and so it was.

‘Experience taught me these lessons in the capture of the Swallow-tail. When in the neighbourhood of flowers, take it gently; move slowly up to the insect, and when within a couple of yards secure it with a dash. This is all easy enough; but when forced into a smart chase over the fen, the following manœuvre proved successful. I found that the pursued insect, after a long flight, generally branched off at a right angle; so that if I kept a respectful distance behind, and when it altered its course turned at an acute angle in the same direction, I was fortunate enough to meet the object of my chase, so that the Butterfly and I formed a right-angled triangle. *Intelligisne?* I think the description clear, though it may perhaps smell a little of the mathematical odour of the ‘Varsity. We caught in the two hours thirty-five specimens, one of which I send herewith. Several, however, were much worn; no doubt through creeping about in the herbage during the preceding unfavourable weather for flight. My brother obtained eleven larvæ from the same spot last year. All the pupæ have not yet disgorged their contents. An imago gladdens my eyes every now and then. Several of the specimens have slightly different markings. One, however, has the hind margins of the under wings lightly coloured with the same chestnut-red hue which composes the prevailing tint in the large spot close to the anal angle of each wing; a unique variety, I believe.’

The egg of this insect is light green in colour and oval in shape. It may seem rather superfluous to say that an egg is oval in shape, but we shall presently see that many eggs of Butterflies are anything but oval in shape. Just before the egg is hatched, its colour darkens until it is nearly black, which in fact is the colour of the young caterpillar. As soon as the larva is hatched, it eats the shell of the egg in which it has been developed, and after every change of skin it eats in like

manner the garment which it has thrown off. The colour of this caterpillar is a beautiful leafy green, the interstices between the segments being velvet-black. Upon each of the twelve segments of the body there is a black bar, which in all the segments except the second is adorned with six orange spots. There are other markings, but these are the most characteristic.

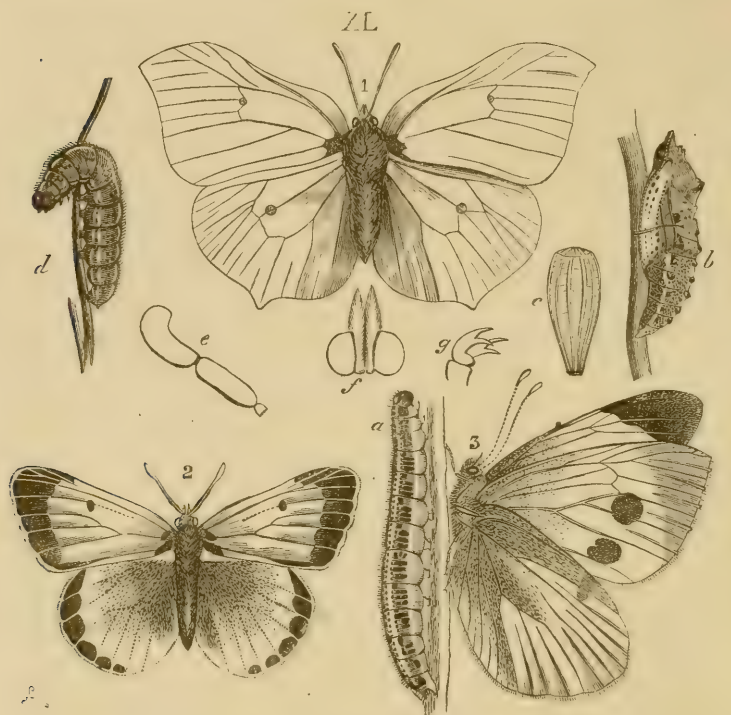
This beautiful larva feeds on several plants, such as the hog's-wort, or cow-parsnip (*Heracleum sphondylium*), the marsh-parsley (*Peucedanum palustre*), and even on the leaves of the common carrot, when nothing better can be obtained. Larvæ of this splendid Butterfly have been successfully reared upon carrot leaves.

When the caterpillar is full-fed, it quits its food-plant, crawls up the stem of a weed, and there assumes the pupal form, binding itself to the weed by a sort of belt, like that of the chrysalis shown in Woodcut XL. Fig. *b*. This belt may be almost called a cable, for it is very stout and strong, as well as elastic, and will sustain a considerable tension before it is snapped. There are many British Butterflies whose pupæ are thus girt to the object on which they undergo their transformation. Mr. Newman gathers these together in a group, which he terms *Succincti*, or Girted Chrysalids. All these pupæ have the head directed upwards.

THE next family, the Pieridæ, is distinguished by the fact that the hind wings form a sort of receptacle in which the abdomen lies. The larvæ do not possess the nuchal horn, and are wider in the middle and narrower at the two ends. The insects which compose this family are the most familiar of our English Butterflies, and are popularly known as White Butterflies. There are, however, several White Butterflies that do not belong to this group, and several that belong to it which can scarcely be called white. However, the popular name is expressive, though not wholly accurate.

Common as they are, they have raised great controversy among entomologists, and have been shifted backwards and forwards into the various genera, until it is scarcely possible to reconcile the conflicting statements. 'Who shall decide when doctors disagree?' So we will not attempt to decide upon

such a subject, but accept Doubleday's system. In accordance with this principle we proceed to the best known of all our Butterflies, the LARGE CABBAGE BUTTERFLY (*Pieris brassicæ*), which is drawn in Woodcut XL. Fig. 3. As to the colours of this insect, they are simply black and white, so that the illustration gives us a very good idea of the colour as well as of the



1. *Gonepteryx rhamni*. 2. *Colias edusa*, male. 3. *Pieris brassicæ*. a. *Pieris*, larva.
 b. Do., pupa. c. Do., egg. e. Do., palpus. f. Do., head. g. Do., claw of foot.
 d. Larva of *Colias*.

form of the insect. The specimen represented is a male; the female being similarly coloured, but without the two large black spots on the fore wings. In its larval condition this is a most destructive creature, and does great damage to the plant from which it takes its name. It is, in fact, so destructive that those who keep kitchen gardens, or are interested in agriculture, should ruthlessly kill every Cabbage Butterfly that comes across them. There is no cruelty in doing so, for no one has

any scruple in killing the caterpillar, and it is surely better to kill one Butterfly than fifty or sixty caterpillars which it produces.

At Fig. *c* is shown the egg of this insect. The reader may remember that, when treating of the Swallow-tail Butterfly, I stated that all insect eggs were not oval. This egg is an example of a considerable departure from the oval shape. These eggs are deposited in small clusters, varying from two or three to twelve, and they all stand upright on their bases, just like a number of little bottles, being fixed to the leaf by a gummy secretion. The caterpillars are hatched in about a fortnight, and grow very rapidly. One of them is shown at fig. *a*. When full-fed they ascend some convenient object, and change into the pupa, which is fixed by its tail, and prevented from falling by a stout silken belt passed loosely round its body. This pupa is seen at Fig. *b*. Its colour is grey-white, with a slight dash of blue, diversified by a number of little black spots. The point of the head is yellow, and so is a line along the ridge of the back.

There are two broods of this destructive insect, the first in May and the second in August, so that, if its numbers were not kept down by the ichneumon flies, we should scarcely have a cabbage in England. I have dissected the larvæ of all our common Lepidoptera, and never found any to be so afflicted with the ichneumon as that of the Cabbage Butterfly. Indeed, the difficulty was to find one that was not being slowly consumed by the tiny but fatal larvæ of the Microgaster, which has been described on page 325.

Other details of this insect are given on Woodcut XL. Fig. *e* representing the palpus, *f* the head, and *g* the claw of the foot.

THERE are several other Butterflies which go by the popular name of Whites. There is, for example, the BLACK-VEINED WHITE (*Pieris crataegi*), which is without spots, but the nervures are black. This is, in consequence, an admirable insect for the study of the wings. It is a local and somewhat intermittent insect, and appears about Midsummer.

Then there is the SMALL WHITE (*Pieris rapæ*), a very variable Butterfly, in which the male is nearly white, except a clouding at the tips of the upper wings, and a rather indistinct

dark spot on the costal edge of the lower wings. The females are at once distinguished by having two black spots on the disc of the upper wings. The caterpillar is a pretty green larva, and is a very indiscriminate feeder. I have bred a long series of them from mignonette growing in a window-box. The Butterfly appears in the midst of summer.

The GREEN-VEINED WHITE (*Pieris Napi*) may be known by the peculiarity from which it takes its name. When inspected from below, the under surface of the lower wings is seen to be dull yellow, the nervures being edged with a greyish tint, which has the effect of green when contrasted with the yellow. The upper wings have much the same colouring, but not so strongly marked, except at the tips. It is a variable insect, and the varieties have been considered by some authors as being three distinct species, one of which they call by the specific name of *Napi*, another by that of *Napeæ*, and a third was called *Sabelliceæ*. Indeed, I find, on referring to my old cabinet, which I arranged according to Stephens's system, these varieties under their different names. This caterpillar feeds on the watercress and one or two other plants.

Lastly, there is the GREEN CHEQUERED WHITE (*Pieris Daphnidice*), which derives its name from the beautiful green mottlings of the under surface of the lower wings. It is a very local insect, and is generally taken on the coast of Kent. Mr. E. Newman has a theory that, although a few specimens may be had in England, it is properly a French insect, and is blown across the Channel. This theory is strengthened by the fact that Butterflies have been seen to cross the Channel, settling on the water when tired, and taking to wing without difficulty. August is the best month for finding this insect.

There is also the little WOOD WHITE (*Leucophasia sinapis*), a small, rather narrow-winged, slow-flying insect, with white wings clouded with black at the ends of the upper pair. Generally this spot, or cloud, is more or less squared.

CLOSELY allied to the Whites is the beautiful ORANGE-TIP (*Anthocharis cardamines*), so well known by the orange-tipped wings of the male, from which it derives its popular name. The female is without the orange hue, but both sexes have the

under side of the lower wings beautifully mottled with green. The insect is as plentiful as it is beautiful, and may be captured in almost every meadow or lane in the early summer. It does not fly very fast, and generally keeps rather low, so that there is no difficulty in taking it. The caterpillar feeds on various cruciform plants, and its colour is opaque green.

ON Woodcut XL. Fig. 1 may be seen a drawing of a very well-known insect, the BRIMSTONE BUTTERFLY (*Gonepteryx rhamni*), the popular name being derived from the beautiful deep yellow of the male. The female is very much paler, as if the colour had been washed out of her, and in both sexes there is a little orange-red spot on each wing, the position and shape of which are indicated in the illustration. In this genus the wings are boldly angled at their tips, from which circumstance the name of *Gonepteryx*, or 'angle-winged,' has been given to it. The antennæ have a peculiar curve downwards, which can be seen by viewing the insect sideways.

This is one of our earliest Butterflies, sometimes making its appearance even in winter, should the sun happen to shine brightly. I see, by reference to my notes, that I took it at Oxford in February. These early specimens are, in fact, the Butterflies which are developed in the autumn of the preceding year, and which had retired to some secluded spot wherein to hibernate. The warmth and light of a bright, sunshiny day awake them from their torpor, and tempt them into the open air.

I believe that such early Butterflies only live a few hours, because the exertion of flight causes them to need food, and no food is to be found at that time of year. It is a remarkable fact, noticed by Mr. Newman, that, although both sexes of the Brimstone Butterfly are developed in the autumn, they take no notice of each other unless they happen to survive to the following spring. The larva of this Butterfly feeds on the buckthorn (*Rhamnus*), from which it derives its specific name of *Rhamni*. The colour of the larva is green, but the surface of the body is thickly covered with tiny black projections or warts, each tipped with a slender white point.

ON Woodcut XL. Fig. 2, is represented one of the prettiest of our Butterflies, the CLOUDED YELLOW (*Colias edusa*).

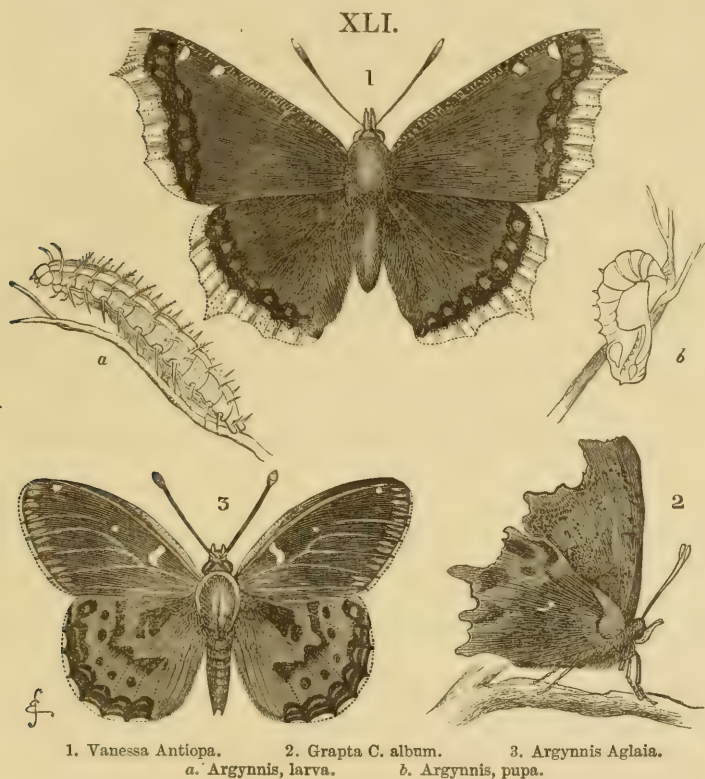
All those who have studied the *Lepidoptera* must have been struck with the marvellous variety and contrast of colour that can be produced by one or two hues. This insect is nothing more than black and orange, and yet is a singularly handsome one. The upper wings are warm orange, edged with a deep border of black, in which are a few pale orange spots in the female, the black band of the male being unspotted. There is also a bold black spot near the upper edge. The lower wings are coloured in much the same way, except that the orange is pale, and approaching to yellow. There is, however, a warm orange spot on the disc. Both pairs of wings are edged with a very warm border of orange, brighter and warmer in the upper than in the lower pair. Beneath, the colour is yellow, warming into orange on the disc of the upper wings, and the spot on the lower wings is brown, with a white centre.

This handsome Butterfly is widely spread, and occasionally occurs in considerable numbers, especially in and near our Southern coasts. I have a number that were taken by my brother at Sheerness, and others taken by myself in Oxfordshire and Wiltshire. It is found in best condition at the end of summer, and through the autumn; but, as it is a hibernator, individuals are seen in the early spring, somewhat shabby and worn in appearance, and lacking the brilliancy which distinguishes the newly-developed insect.

The larva is grass-green in colour, and is covered with a great number of tiny bristle-bearing warts. It feeds on the clover, and consequently clover fields are much haunted by the perfect insect. The eggs are long and narrow, and have been compared to ninepins in shape. They are affixed to the leaf by one of the ends, so that they stand upright. The larvæ are hatched about Midsummer. One of them is shown on Woodcut XL. Fig. *d*. The chrysalis, or pupa, is attached by its tail and a belt, like that of the Cabbage Butterfly, and does not seem to be very particular as to its position, generally being upright, but sometimes horizontal.

WE now come to the beautiful family of the *Vanessidæ*, which includes some of our handsomest and best-known Butterflies. Among other distinctions, in all these insects, the first pair of legs are very small, and not used in walking.

Our first example is the DARK GREEN FRITILLARY (*Argynnis aglaia*), a figure of which is given on Woodcut XLI. Fig. 3. The Butterflies belonging to this genus are popularly known as Fritillaries, and all of them have the under surface of the lower wings adorned with metallic spots and markings which look as if made of burnished silver. The generic name *Argynnis*, which



is taken from the Greek, signifies 'brilliant' or 'shining,' and is given to the insects in consequence of this peculiarity. The colour of the present species is bright warm brown in the male, marked with a dark bronze-green in the female. The wings are profusely spotted with black on the upper surface, and on the under surface of the lower wings are a number of round bright silver spots, and near the margin of the wing is a row of seven semicircular silver spots.

This insect is generally spread over England, and is plentiful in many parts of Kent, especially on the downs which lead towards the sea. Mr. Newman remarks that hilly, fern-covered ground is the best locality for this Butterfly. The larva, which is shown at Fig. *a*, feeds on the dog violet (*Viola canina*). Its colour is very dark shining grey, mottled with black. When full-fed, which takes place about the middle of July, it selects a suitable spot, and there changes into a pupa, suspending itself by its tail, which is very strongly curved. One of these pupæ is shown at Fig. *b*. It remains in the pupal state about eighteen days, and then emerges in its perfect form.

There are five other species of the Fritillary, all of which are very similar in their colouring. As they are liable to variation, the beginner finds great difficulty in identifying them. This, however, can generally be done by means of the silver markings on the lower wings, which in some species form bold, clearly defined spots, like solid silver leaf, and in others take the shape of marks or streaks, just as if a brush had been dipped in silver powder and drawn over the wing. The larvæ of all the species are spiny, and feed upon the violets and their kin.

NEXT we take the typical genus *Vanessa*, of which we must examine several examples, as they are among the most conspicuous of our insects. In this genus the club of the antennæ is short and bold, the first pair of wings are more or less regulated, and the eyes are extremely hairy. If examined with the microscope, it will be seen that the hairs are planted at the angles of the hexagonal facets.

The handsomest and rarest of these Butterflies is drawn on Woodcut XLI. Fig. 1. Its scientific name is *Vanessa Antiopa*, and it is popularly called the WHITE-BORDERED, on account of the broad white edging of the wings, or the CAMBERWELL BEAUTY, because in 1748 three specimens were taken near Camberwell.

My brother saw one on the banks of a railway cutting in Wales, as he was going to church with his wife. Rare insects are always perverse. You may go to the most famous localities for them, furnished with every appliance, search and watch day

after day, and never even see a specimen. Then, just where they are least expected, and when no means are at hand for capturing them, they make their appearance—and generally their escape—in a manner that is calculated to test the temper severely.

In the present instance, the sudden appearance of such an insect at his very feet was too much for the discoverer, and, hat in hand, he dashed down the cutting after the Butterfly. Of course, having taken him to the bottom, it ascended to the top, and so on, giving him a chase of a quarter of an hour perpetually up and down the cutting, and at last getting away over a hedge, leaving its pursuer breathless on the ground, and his hat and clothes generally in a more than dishevelled state. In his letter to me relating the circumstance, he says that if anyone wants to take a Turkish bath, and is not within reach of one, he recommends a chase of the Camberwell Beauty in a deep railway cutting with very steep sides.

The colour of this magnificent insect is rich brown, shot with deep purple. The wings are edged with a broad grey-white band, just inside which is a row of blue spots. This is a very plentiful insect in America and on the Continent, and specimens are often taken from France and passed off as English. They can, however, be detected by the colour of the white band, which in genuine English specimens is grey-white, and in foreign specimens yellow-white.

It is a very capricious insect in its appearance in this country. Owing to the great and rapidly increasing number of entomologists in this country, and the many periodicals which are devoted to Natural History, scarcely a specimen of this conspicuous Butterfly can be at large without being seen and recorded. It seldom happens that a single specimen is thus mentioned; but, if one entomologist happens to be fortunate enough to capture an *Antiopa* on Monday, several others are nearly sure to be caught within the week, and then no more seem to make their appearance. I never had the good fortune to see one of these Butterflies at liberty, and very much suspect that I never shall.

ON Woodcut XLI. Fig. 2, is seen a profile portrait of the COMMA BUTTERFLY, scientifically termed *C. album*, or the

White C. These names are given to the insect because on the under surface of the lower wings there is a curved mark, very much like the letter C in shape, and of the purest white. There is not the least difficulty in identifying this insect, even without taking the trouble to inspect the under surface, for both pairs of wings are so deeply scalloped that there is no possibility of mistake. The upper surface of the wings is warm red-brown, mottled with black, both the ground hue and the markings being subject to considerable variation.

This is considered to be an inland species. In those places which it frequents it is common enough. I have taken many specimens in Bagley Wood, near Oxford, in the days when that beautiful little wood was one of the finest insect preserves in England.

The larva is known to feed on the elm, the hop, and the currant, and in the midland counties is said to be common in the hop-growing districts. It is a thick spine-bearing larva, grey in colour, mottled with chestnut, and having a white stripe along part of its back. The perfect insect appears in the beginning of autumn.

NEXT we come to the GREAT TORTOISESHELL (*Vanessa polychloros*), which is drawn on Plate XIII. Fig. 1.

This handsome insect is well named, as its rich mottlings of black and warm chestnut-brown bear no small resemblance to the colours of the tortoiseshell. In some parts of England this species is tolerably common, while in others it is never found. The first specimen that I ever took I saw in the window of a grocer's shop at Oxford, one of the very last places where one might have expected such a Butterfly to be found. It was quite plentiful in Bagley Wood, where any number could have been taken, and had evidently been blown into the streets and then attracted by the sugar in the window.

It is common in Kent. Lieut.-Col. C. J. Cox, who has given great attention to this insect, told me an anecdote of the mode in which it deposits its eggs. He watched a female deposit an egg or two on a leaf, and, wishing to rear the insect from the egg, he cut off the branch and removed it. The Butterfly, however, continued to fly up and down near the spot, and refused to leave it, evidently searching for the leaf on which

PLATE XIII.
BUTTERFLIES.

1. *Vanessa polychloros*.
2. *Vanessa Atalanta*.
3. *Vanessa cardui*.

PLANTS:—

Meadow Crane's Bill (*Geranium pratense*). Above, on Right.
Buttercup (*Ranunculus bulbosus*). In Middle.



she had deposited her eggs. The branch was then restored to its place in the tree, as nearly as could be done. The Butterfly at once saw and recognised it, proceeded to the same leaf, and deposited more eggs upon it.

THE SMALL TORTOISESHELL, or COMMON TORTOISESHELL (*Vanessa urticae*), is coloured much like the preceding insect, but the hues are rather brighter, and the whole pattern of the wings defined more clearly, and looking more compressed. It is too familiar to need any detailed description. The caterpillar feeds on the common stinging-nettle, and may be found in great numbers upon it, sometimes being so numerous as to blacken it with the caterpillars clustering upon the leaves, which are drawn together with the silken threads spun by the larvæ. The pupa is suspended by the tail, and is very angular. Its colour is brown, mottled and spotted with black, and having several patches of a brilliant gold, as if burnished gold leaf had been laid upon it. This beautiful colouring has given to the pupa the name of *Chrysalis*, this being a Greek word, signifying anything that is gilded. The golden hue is unfortunately very transient, and vanishes as soon as the Butterfly has emerged from the pupal envelope.

The splendid, and fortunately common, insect, the RED ADMIRAL (*Vanessa atalanta*), a figure of which is given on Plate XIII. Fig. 2, comes next in order. This Butterfly can be at once recognised by the broad scarlet band near the upper wings and along the edge of the lower wings, a bold and conspicuous style of colouring possessed by no other British insect. The ground-colour of the wings is velvet-black, diversified with some large white spots on the tips of the upper pair of wings, and an oval blue spot on the anal angle of the lower pair. It is easy enough to describe the markings of the upper surface, but those of the lower surface are almost beyond description. Suffice it to say that the colour of the first pair is much like that of the upper surface, only paler; while the under surface of the lower wings exhibits a most complicated mottling of brown, grey, blue, green, ochre, and black, arranged in a marvellously artistic manner, and forming a series of definite, but complicated patterns.

If this beautiful Butterfly were only rare, it would be the

admiration of all collectors. As it is plentiful, it is only admired by those who value Nature for her own sake, and not for the sake of mere rarity. Being one of the latter kind, I have a most enthusiastic admiration for the Red Admiral, and am never tired of examining it in the cabinet, or watching it as it flits at liberty in the open air, with the graceful flight that has earned for the insect the name of *Atalanta*.

The larva of this Butterfly is a nettle-feeder, and is quite common. It is not, however, so often seen as that of the Tortoiseshell Butterfly, as it always feeds in concealment, making a shelter by drawing together with silk the leaves of the plant on which it feeds.

Even when it has ceased eating, and is about to pass into the pupal state, it has the instinct of concealment strong upon it, and ensures a convenient retreat by nibbling the stalk of the nettle nearly asunder, some four or five inches from the top. The severed portion, of course, falls over, and is spun up with silk so as to leave a hollow cavity within which the caterpillar can undergo its changes. The chrysalis, which may be found at the end of summer, is suspended by its tail from the roof of this habitation, and there hangs until the perfect insect makes its escape. This chrysalis, like that of the preceding insect, is adorned with brilliant golden patches on the sides, and its general colour is warm grey, mottled with black.

Mr. Newman mentions that he has captured the *Atalanta* at night, as it was feeding on the sugar which had been laid out for the purpose of attracting moths. I am not aware that any other Butterfly has been known to depart so greatly from the usual day-flying habits of the group. As in the case with other insects of the same genus, though the Butterflies are developed in the autumn, the two sexes take no notice of each other until the following year, but occupy themselves with flitting about from flower to flower, and in sucking their sweet juices. During the winter they hibernate, and at the beginning of the following summer they seek their mates and lay their eggs, from which the future brood is to proceed.

In consequence of this habit, those specimens which appear at the beginning of summer are never in fine condition as to their plumage, their wings being battered and faded during the previous year. Those, however, which make their appearance

in August, are in their full splendour, and, unless the collector prefer rearing them from the caterpillar, he should select the month of August as the time for the capture of specimens for the cabinet.

Although it can fly rapidly when it chooses, it seldom takes the trouble to do so, and appears, indeed, to be so engaged in searching for and taking food that it may be captured without the least difficulty. Ripe and fallen fruit is always a great attraction for this Butterfly. One of the most magnificent sights I ever saw was due to this predilection for fruit. An egg-plum tree had been entirely neglected, and its fruit permitted to ripen on the boughs and then fall to the ground. A lot of insects took advantage of such an opportunity, and the tree and its vicinity swarmed with wasps, ants, and other lovers of sweets.

But the most striking point was the host of *Atalanta* Butterflies which surrounded the tree. They were approaching in every direction; the branches were crowded with them, and the fallen fruit upon the ground was so covered with them that neither fruit nor ground could be seen for the Butterflies, as they waved their black and scarlet wings gently up and down. So completely occupied were they with their rich banquet that they took no notice of me as I stood by them, and even permitted me to pick them up with my fingers. The sun was shining brightly on this wonderful assemblage, and brought out the grandly contrasted colours until they shone with tropical splendour. I never saw such a sight before, and am not likely to see such a one again.

On Plate XIII. Fig. 3 is shown the pretty Butterfly called, on account of the variegated colouring of the under surface, the Painted Lady. Its scientific title is *Vanessa cardui*. The shape and position of the markings can be seen by reference to the illustration. The colour of the upper wings is deep black. The five spots near the tip are pure white, and the pale markings on the disc of the wings are warm chestnut. There is a slight white scalloping along the edge of the wing. The lower pair of wings are coloured in much the same way, but the only white portion is the scalloped edging. The bases of the wings are thickly covered with scales of a

golden lustre. I would here take the opportunity of advising any of my readers who possess a microscope, to examine carefully the scales of every lepidopterous insect that they capture, taking a few from both surfaces of the wings. If care be taken, these lovely objects can be removed without damaging the beauty of the wings. The under surface of the lower wings is beautifully mottled with various shades of brown and yellow, and near the edges are four rounded spots in a row, the two exterior spots being twice as large as the others. Each of the large spots is composed of a glittering green centre, surrounded by warm brown. Round the brown is a stripe of yellow, and the whole is surrounded with a bold black line. The two smaller spots have no black outline.

In its larval state, the Painted Lady feeds on the thistle (*Carduus arvensis*), from which the insect derives its specific name of *Cardui*. It prefers the young and tender leaves of the plant, and draws their edges together, so as partially to enclose itself in the leaf. When it changes into a pupa, it suspends itself by the tail, and there remains until it emerges in its perfect form, somewhere about August.

In its habits, the Painted Lady much resembles the preceding insects, becoming developed in the autumn of one year, but not pairing until the spring of the next year. It is fond of flitting about in search of honey-bearing flowers, and especially frequents the teasle, on which flower the Red Admiral, the Great Tortoiseshell, and the Peacock Butterfly often bear it company. I have taken all those insects plentifully on teasles in Bagley Wood, near Oxford.

As in the case with other Butterflies, the Painted Lady is wonderfully intermittent in its appearance, sometimes being absent or extremely scarce for several years, and then appearing in swarms for a year or two in succession. I well remember the year in which I first saw this beautiful insect in any number. I had in my cabinet one solitary, battered specimen, the only one that I had ever seen since I had begun to collect. One autumnal day I went to Bagley Wood, and near the road saw a Painted Lady fly into a gravel-pit. I went after it at best speed, jumped into the pit, and found it absolutely full of Painted Ladies. The Butterflies had taken some strange fancy to the place, and were flying through it almost in streams.

They were all in splendid condition, and in a very short time I had captured a sufficient number to fill my box.

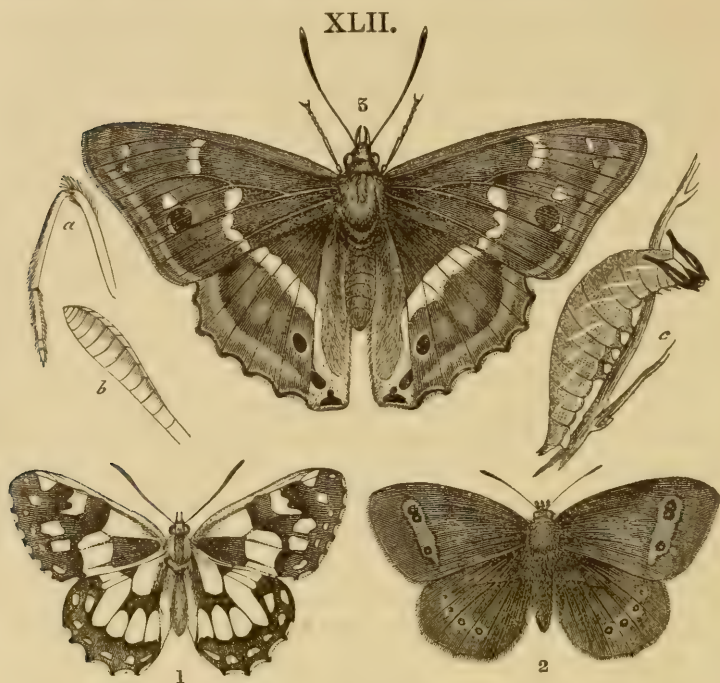
WE must not complete our notice of this genus without a brief mention of the beautiful PEACOCK BUTTERFLY (*Vanessa Io*), so conspicuous on account of the 'eyes' or circular marks on both pairs of wings. The under surface of the insect is brown-black, mottled in a most curious but almost indescribable manner. Whether the sombre colouring be intended for defence I cannot say, but there is no doubt that the insect often owes its life to the contrast between the upper and under surface. When a Peacock Butterfly is chased, it has a way of flying round a tree trunk, and settling on it, closing its wings at the same time, and bringing them together over its back. In this attitude it looks wonderfully like a dead leaf, and the change from a large, active, beautifully-coloured butterfly, to a thin, black, shrivelled leaf, is so great and so rapid that scarcely any eye but that of an entomologist would detect the insect.

The larva is one of the nettle-feeders, and is mostly very common, in some places quite as plentiful as that of the Tortoiseshell, while in others it has to be searched for carefully before it can be found. The general colour of the caterpillar is black, and the body is covered with a great number of long spines, which may, perhaps, defend it from the poisonous spikes of the plant on which it feeds. The chrysalis is green in colour, brighter when the change is first made, and darker when the future Butterfly is nearly developed.

ON Woodcut XLII. Fig. 3, is shown one of our handsomest Butterflies, the celebrated PURPLE EMPEROR, or EMPEROR OF MOROCCO (*Apatura Iris*). This genus differs from *Vanessa* in having the club of the antennæ long instead of knobbed, as is shown at Fig. *b*, and the club nearly straight. The eyes are without hairs, the hind wings scalloped, and the first pair of legs are not used for walking. At Fig. *a* is shown one of these partially developed limbs. Those legs that are seen at Fig. 3 are the second pair, the first pair being tucked up under the front of the thorax. Only one species inhabits England.

Those of my readers who do not restrict their studies to

contemporary literature are doubtless familiar with 'Peter Pindar's' poem on Sir Joseph Banks and the 'Emperor of Morocco,' certainly one of the best of his inimitable witticisms at the expense of science. The present insect is the 'Emperor of Morocco,' who led Sir Joseph such a chase, and left him at last in the hands of an exasperated market-gardener.



1. *Arge Galathea*. 2. *Erebia blandina*. 3. *Apatura Iris*.
a. *Apatura*, non-walking fore-leg. *b.* Do., club of antenna. *c.* Do., larva.

Its popular name of Purple Emperor is a very appropriate one, at least as far as regards the male insect. The ground colour of the upper wings is brown-black in some lights, but in others is a rich shining purple, this effect being produced by the shape and arrangement of the scales, as can be seen by examining a specimen under the microscope. The light-coloured bands and spots are white, pure white in the male, and yellowish-white in the female. Beneath, the general colour is rust-red, blotched with black, grey, and here and there blue.

When I first began to collect the British Butterflies, the Purple Emperor was considered one of the great prizes of entomologists—hardly inferior, in fact, to the Great Copper, which seems to have totally disappeared from the country. In those days the Emperor was supposed to restrict himself to the topmost branches of the oak-trees, and entomologists were accustomed to supply themselves with nets furnished with long handles made on the principle of the fishing-rod, the handle of the net being at least thirty feet in length. It so happened that I was engaged in getting together an illustrative series of insects for the Anatomical Museum at Oxford, and happening to possess a specimen of the Purple Emperor, I merged my personal feelings in the public welfare, and presented to the Museum my valued specimen.

There is a well-known saying to the effect that ‘Virtue is rewarded,’ and so it turned out on this occasion. A very short time after the personal sacrifice above-mentioned, a friend sent me a couple of Purple Emperors, male and female, which he had captured in Bagley Wood, while they were drinking in a puddle. Since that time the habits of the insect have been carefully studied, and the result has been that the Purple Emperor has been rendered comparatively familiar. Beautiful as it is, it has a strange liking for the most repulsive viands. There is nothing it likes better than the juices of putrid animal substances, and a dead dog or cat, which would drive away any human being who possessed nostrils and was not an entomologist, would attract the Purple Emperor to a rich banquet.

Now-a-days entomologists who wish to catch the Purple Emperor do not trouble themselves to procure nets with preposterous handles—weapons with which I scarcely believe that a successful stroke can be made. They now look out for a secluded open space or glade in the wood, situated, if possible, on wet soil, lay on the ground a piece of bullock’s liver, a dead rat or rabbit, or, in fact, any kind of animal substance, and go away again. The best plan is to make a circle of half a mile or so in diameter, and lay down the baits at distances of a few hundred yards.

In two or three days, according to the weather, they come back again, and steal quietly to the spot. Should the district

be one that is favoured by this insect, very few of the baits will be without a Purple Emperor either settling on it or being at hand; and, like the Red Admiral, when engaged in taking food, the insect is so absorbed in its occupation that it can be taken without the least difficulty. If the locality be well selected, and the baits judiciously laid, it is very seldom that the entomologist will complete his round without having the opportunity of capturing this splendid Butterfly. So successful is this method of capturing the Purple Emperor that one entomologist succeeded in taking eighty specimens in nine days.

The caterpillar or larva is a very odd-looking creature, and is represented on Woodcut XLII. Fig. *c*. The most conspicuous points in this curious larva are the two horns with which the head is furnished. It feeds on the sallow, and, when partly grown, assumes so nearly the colour of the leaf that a sharp eye is needed to detect it. There are many markings and shades of colour in the caterpillar which need no notice, the general green hue and the horned head affording characteristics which cannot be mistaken. The perfect insect appears somewhere in July, the precise date depending much on the weather.

NEXT comes the family of the Satyridæ, in which the first pair of legs are not used for walking, the club of the antenna is bold and abrupt, and the wings are rounded. The larva has no spines, and the pupa is nearly smooth. Our first example is the MARBLED WHITE (*Arge Galathea*), which is drawn on Woodcut XLII. Fig. 1. The colours of this pretty insect are simply black and yellowish-white, the amount of yellow differing according to the sex. The under surface is paler than the upper. The first pair of wings have a small eye-like spot near the tip, and on each of the second pair there are six similar spots arranged in a row near the edge of the wing. The row is not complete, there being a gap between the third and fourth spots. The larva feeds on grass, and the pupa does not suspend itself, nor indeed take any trouble in securing a resting-place. The perfect insect appears in July, and is very plentiful in many places, while in others it is scarcely ever seen. The sea-coasts of Kent are favoured localities of this Butterfly, especially the country near Dover, Folkestone, and

Margate. Some years ago I took a great number of Marbled Whites in a field near St. Margaret's Bay, and could have filled a cabinet with them in a few hours. Sometimes this Butterfly frequents a certain pasture field, which is a sure locality for it. Then if the field be ploughed up, and devoted to corn or clover, the Butterfly vanishes entirely from the neighbourhood.

ANOTHER insect belonging to this family is given on Woodcut XLII. Fig. 2. Its popular name is the NORTHERN BROWN (*Erebia blandina* or *Medea*). The latter of these names is the older in date, and although not so familiar as the former name, has been restored by Mr. Newman on the score of priority.

The colour of this Butterfly is deep blackish-brown, with an indistinct broad band of rust-red running nearly parallel with the hind margin of the wings. These bands are adorned with black eye-like spots, with centres of pure white. The two first spots of the upper wings are always united so as to form a figure of 8. The under surface of this Butterfly is very pretty, the colours being disposed in a very bold manner. The first pair of wings are dark-brown, with a very broad yellowish band in which are eye-like spots corresponding with those of the upper surface. The second pair of wings are liable to much variety, but may be generally described as grey with two broad waved dark bands. Several little black spots with white centres occupy the space between the bands.

This is not a common insect, inasmuch as it belongs more especially to the northern portions of our island; and, though it is very plentiful in some parts of Scotland, is the rarest of the rare in the southern counties.

There are several other well-known Butterflies belonging to this family, but our space will not permit of description. Such, for example, are the SPECKLED WOOD BUTTERFLY (*Satyrus Egeria*), the WALL BUTTERFLY (*Satyrus Megæra*), the GRAYLING (*Satyrus Semele*), the MEADOW-BROWN (*Satyrus Janira*), and the RINGLET (*Satyrus Hyperanthus*), the last-mentioned insect being remarkable for the fact that the upper surface of the wings is perfectly plain brown, while the under surface is warm brown adorned with sixteen spots, each spot having a white centre,

then a broad black circle, and then an outer circle of white. It is an extremely variable Butterfly, both in the size and number of the spots; but ninety-nine specimens out of a hundred have the sixteen spots, three on each of the upper wings and five on each of the lower wings, the latter being arranged in two groups consisting of three and two spots. All these Butterflies are plentiful, and can be caught without difficulty in lanes or fields, their flight being sluggish, and never rising much above the ground.

WE now pass to the family of the *Lycænidæ*, in which are included those small, but very lovely Butterflies which are known by the popular name of Blues and Coppers, in allusion to the prevalent tints of their wings. The latter insects are seldom seen except by those who go to look for them, but the former are prevalent everywhere, fluttering low over wide downs, settling on wild flowers, or aiding in adorning our gardens with their beautifully variegated wings. I well recollect that one of the chief pleasures of my childhood was to watch for the appearance of the Blue Butterflies in our garden at Oxford, a locality for which some of the species had a special predilection.

They might well frequent that garden, for I never killed but one of them, and that was for the purpose of examining the spots on the under surface by the aid of a small pocket microscope—to which instrument I owe much of my attachment to Natural History. Children have strange ideas in their little heads, and in my own brain as a child was a deeply rooted conviction of some affinity between the Blue Butterflies and the flower of the sweet-pea. I have plenty of children of my own now, but I can never see a Blue Butterfly without thinking of a clump of sweet-peas, an old garden wall, a snow-berry bush, and a lattice-sided summer-house, covered with vine-leaves and grape-clusters. Neither wall, bush, summer-house, nor vine has now an outward existence, but they are as vividly present to my memory whenever I see a Blue Butterfly as they were when I was a child of six years old.

ON Woodcut XLIII. Figs. 1 and 2, is shown the rarest, even if not the most beautiful, of these Butterflies, the

celebrated GREAT COPPER BUTTERFLY (*Polyommatus* or *Chrysophanus dispar*).

The two sexes of this insect are very differently coloured. The male is fiery copper above, with a little blackish spot and a black hind margin to the upper wings. The lower wings are also edged with black, and have a slight streak in the middle.

XLIII



8-11

1. *Polyommatus dispar*, female. 2. Do., male, under surface. 3. *Polyommatus Adonis*.
4. *Hesperia Paniscus*. 5. *Hesperia alveolus*. a. *Polyommatus dispar*, larva. b. Do., pupa.
c. Do., antenna. d. Do., palpus.

The female has the upper wings marked with a broad black edge and a number of black spots, as shown in the illustration. Her under wings are brown, edged and spotted with black, and have a copper band parallel with the hind margin. Beneath, both sexes are alike, the upper wings being orange, diversified with a number of deep black spots, most of which are surrounded with a grey line. The under wings are grey, with an

orange band corresponding with the copper band of the other side, and a number of grey-edged black spots.

Fig. 1 represents the female, and Fig. 2 the male.

The larva is a sluggish and slug-like creature, feeding on the great water dock (*Rumex hydrolapathum*), which only grows in wet places. It moves very slowly, and, as the colour almost exactly resembles that of the leaf on which it feeds, it is not easily seen. This caterpillar is shown at Fig. *a*, and the pupa at Fig. *b*. Fig. *c* represents one of the antennæ, Fig. *d*, the palpus.

As far as England goes, this handsome Butterfly is now extinct. In former years it was tolerably plentiful in the fens of Cambridge and Huntingdon, but no specimens have been seen for many years, and, in all probability, the last British specimens were taken in 1848.

A good example of the Blue Butterflies is given on Woodcut XLIII. Fig. 3. This is the CLIFDEN BLUE (*Polyommatus Adonis*).

The colour of this pretty species is bright shining blue, with a delicate white line on the costal margin of the forewings, and a black line on the hind margin. The fringe of the wing is pure white, with a black spot at the end of each nervure. The female is brown on the upper surface, with a slight gloss of blue, and on the fore-wings is an indistinct blackish spot on the disc, and a number of small spots parallel with the hind margin. Both sexes have the under-side of the wings brownish, with a number of little spots. This Butterfly is found on chalk downs and similar places, but seems to be restricted to those spots where there is a substratum of chalk.

PASSING of necessity by the rest of the Blues and the little Butterflies called by the name of Hair-streaks, we come to the family of Hesperidæ, popularly known by the name of Skippers, probably on account of their quick, uncertain flight. They are all small insects, coloured with brown, black, grey, and white, and very thickly and clumsily made, so that many persons unskilled in entomology take them for moths. They have the fore-legs fitted for walking, and when at rest they

hold their wings only partially erect, and never pressed closely together, as is the case with the previously-mentioned Butterflies. They are plentiful in country lanes, and are often taken in the net when the stroke is made at other insects, their vague and almost jerking flight carrying them into it.

The pupæ of these insects resemble those of several moths in the manner in which they are protected during their helpless state of existence. When the larva is full-fed, it spins a cocoon among the leaves of its food-plant, and in that silken cell awaits its change into the perfect condition.

The species which is represented on Woodcut XLIII. Fig. 4, is the Chequered Skipper (*Hesperia paniscus*). The colour of its wings is dark brown, upon which are a number of yellow spots, arranged as shown in the illustration. The antennæ are bright yellow beneath, and banded with black and yellow above. It is rather a local species, and is found chiefly in the Midland counties. It appears in the beginning of summer.

A MORE common species, the GRIZZLED SKIPPER (*Hesperia malvæ* or *alveolus*) is shown on Woodcut XLIII. Fig. 5. The wings are nearly black, sprinkled with white spots, as shown in the illustration. The antennæ are white, ringed with black. There are, however, several varieties of colouring, one of which is so constant that the insects have been considered to form a different species, under the name of Scarce Grizzled Skipper.

The larva of this species feeds on the common bramble, and draws together the edges of the leaves, so as to form a temporary habitation. Its colour is brownish green, with a few dark stripes, and the pupa is greyish white, spotted with black. The perfect insect appears at the beginning of summer.

CHAPTER II.

HETEROCERA, OR MOTHS.

THE NOCTURNI, INCLUDING THE SPHINGES AND BOMBYCES OF LINNÆUS.

It has already been mentioned that there is no difficulty in distinguishing English butterflies from English Moths. Similarly, there is none in distinguishing English Moths from English butterflies.

In the first place, the antennæ of these insects are not knobbed at the end, but pointed. Some of them have the ends of the antennæ much enlarged, as may be seen by reference to the Moths on Plate XIV. and Woodcut XLIV. In all these, however, the club of the antenna is elongated, and the end is pointed. Moreover, whereas in the butterfly the shaft of the antenna is straight and simple, in many of the Moths it is curved, and in others is adorned with a feathering, sometimes on one side and often on both. For this reason the scientific name of *HETEROCERA*, or 'Varied horns,' has been given to these insects, just as *Rhopalocera*, or 'Clubbed horns' is given to the butterflies.

Then, the wings of a Moth at rest are not pressed together over the back, like those of the butterflies, but either lie flat on the body or along its sides. The body, moreover, has no waist like that of the butterfly. Keeping these few and obvious distinctions in his mind, the young entomologist need never hesitate to decide to which great group any lepidopterous insect belongs.

THE first family is that of the *Sphingidæ* or *Sphinx-Moths*. They derive their name, not from any peculiarity in the Moths themselves, but in their larvæ, some of which are thought to bear in their attitude a fanciful resemblance to the well-

known Sphinx of Egypt. The Moths themselves are popularly and appropriately called Hawk-Moths, on account of the great swiftness of their flight, which very much resembles that of the hawk tribe. Their whole structure, indeed, shows that they are made for rapid flight, and, if we compare them with the swift-flying birds, especially the swallows and the humming-birds, we shall find that the outlines of Moths and birds are wonderfully similar. Their bodies are of moderate length, and pointed at the tail, and their wings are long, strong, stiff, narrow, and pointed. In fact, if the shadow of a humming-bird and of a Hawk Moth were thrown side by side on the same surface, it would not be easy to tell which was the shadow of the bird and which of the insect.

With a very few exceptions, these Moths fly only at night or in the dusk of the evening, so that to watch their flight is not an easy matter. The best plan is, on some moonlight night, to take a stand near some honey-bearing flowers, to remain perfectly still, and watch quietly. Should there be Hawk-Moths in the neighbourhood, some of them are tolerably sure to come to the flowers, and to feed in their own peculiar manner, by poising themselves in mid-air on their rapidly quivering wings, and thrusting their sucking-tubes or trunks into the recesses of the flower. As these Moths will not fly by day, and as the partial darkness prevents their movements from being seen, it is better to look out for the well-known Humming-bird Hawk-Moth, which does fly by day, and is a very bold insect, allowing itself to be approached quite closely.

OUR first example of the Hawk-Moths is the magnificent DEATH'S HEAD MOTH (*Acherontia Atropos*), a figure of which is given on Plate XIV. Fig. 1.

This splendid creature ranks among the very largest of our insects, inasmuch as the spread of its wings is very considerable, and the body is thick and heavily made. The upper surface of the fore wings is warm-brown, with bands and mottlings of a darker hue, and a little white spot on the disc. The hind wings are yellow, with two black bands. The thorax is densely covered with a soft velvet-like down, feeling to the touch very much like the fur of the mole. The colour is a very deep black-brown, and in the middle is a yellow

mark which bears the most startling resemblance to a skull and the two collar bones. The hair is so long that the shape of the skull can be altered by pressure. The body is yellow, with a longitudinal black stripe along the middle, and six black transverse bands, each marking the edge of a segment. Beneath, the body and wings are yellow, with an indistinct dark band across the middle of each wing and a slightly darkened edging. The antennæ are very thick, covered with down, and furnished at the tips with a sharp hook.

In fact, the chief characteristic of this insect is hair, with which the body, thorax, head, antennæ, and legs are thickly covered, even the wings have a soft, downy aspect, which is due to the structure of the scales. If some of these scales be detached, and examined by means of a microscope, they will be seen to be very large, and increasing in width from the base to the tip, which is modified into four or five long points.

The larva of this Moth is of enormous size, as may be seen by reference to Plate XIV. Fig. 2, in which the larva is drawn of its natural size. It is a very handsome caterpillar, and exceedingly variable in tint, the general colour varying through different shades of yellow, green, and grey. The whole surface is covered with very tiny black dots, and on each side are seven diagonal blue or purple stripes, edged with white. Near the end of the tail is a curious horn-like appendage, curved downwards and then slightly recurved upwards near the point. The horn, contrary to the usual fashion of such horns, is very rough and covered with tubercles.

It feeds on various plants, of which the jessamine and the potato are the favourites, though it may be found in the snowberry, the tea-tree, and the deadly nightshade, this plant being allied to the potato. This caterpillar is invariably called a locust by the country people. As both the caterpillar and Moth are nocturnal feeders, although the country be covered with potato-fields, and the insect be quite plentiful, it will be seen as seldom as if it were one of the rarest of species. In the neighbourhood of my house there are several large potato-fields, and I often have these splendid Moths brought to me, so that I have been enabled to supply my friends with specimens, and to watch their ways when in confinement.

One of the most remarkable points in connection with this

insect is its capability of producing sounds—a capability which is scarcely less striking than the skull depicted upon its thorax. If seized, or alarmed in any way, it produces—for I cannot say utters—a sharp squeaking sound, something like the cry of a mouse. It was always easy to make my Death's Head Moths squeak, nothing more being required than to introduce a little stick under the glass shade which covered them, and to press one of their feet. The aggrieved Moth would then crouch as low as possible, and, with a sort of shiver or tremble of the whole body, out came the squeak.

Although this sound is familiar to entomologists, no one has yet discovered its source. Some have thought that it is caused by the rubbing of the head against the thorax, some by the attrition of the antennæ and trunk, and some by the friction of the thorax against the abdomen. These theories are, however, neutralised by the fact that not only can the perfect insect produce the squeak, but that the caterpillar can do so, which possesses neither trunk nor antennæ, and has no distinctive head, thorax, or abdomen.

It is a remarkable point that agricultural labourers, who have the very best opportunities of ascertaining the habits of living beings, scarcely ever do so, and when they do are invariably afraid of them. The ominous-looking mark on the thorax has always caused the insect to be looked on with dread, not only in this country but on the Continent generally, in the southern parts of which it is very plentiful. The power of producing a sound is another cause of fear, and I have elsewhere narrated an amusing incident, where a whole circle of village people were standing around a Death's Head Moth that had by some mischance got into the churchyard. Not one of them dared touch it, and at last it was killed by the village blacksmith, who courageously took a long jump and came down on the unfortunate Moth with his iron-shod boots.

In this country it certainly does no harm, but in Southern Europe it is said to enter bee-hives and lick the honey from the cells.

Owing to the vast quantity of hair with which the body is covered it is of some consequence to secure specimens that are not damaged by being rubbed, as is generally the case with those that are captured by hand. The best mode of obtaining

really perfect specimens is to rear them from the caterpillar. Labourers are not much afraid of the caterpillar, though they are of the perfect insect, and the easiest mode of obtaining both the larva and the pupa is to go to a potato-field in which the labourers are at work, and offer a small sum for uninjured 'locusts' and 'ground-grubs.'

It will be as well to take a pupa in order to show them the exact object that is wanted. Drawings, however faithful, are, I find, utterly useless, the uneducated eye being absolutely unable to comprehend them. Some time ago, wanting a few living specimens of the Flour Beetle (*Tenebrio molitor*), described on page 146, I made some careful coloured drawings of the insect, took them to different bakers, and asked them to procure some specimens. I do not know whether baking is a business that affects the human intellect or the human eye, but in every case the bakers brought me a paper bag full of cockroaches. And even when the different size, colour, and shape of the two insects was pointed out, the bakers in question could not be made to understand but that one insect 'would do' as well as another.

The caterpillars of the Death's Head Moth being obtained, and a continual supply of fresh potato-leaves ensured, they should be kept as much as possible in the dark. When they are full-fed they should be placed on light soft earth, into which they will burrow, and undergo their transformations underground. It is as well to plant in the soil a few sticks up which the Moth can climb when it emerges, and to which it can cling while it dries its wings. Care must be taken to keep the earth moderately moist, placing damp but not wet moss upon it. Unless this precaution be taken, the outer skin of the pupa will become so hard that the insect will not be able to make its way out when it is fully developed. I have lost several Moths in this way, and have had one or two in a very maimed and imperfect condition, their wings being quite shrivelled, and scarcely one-sixth their proper size.

Against this evil the Moth-breeder can easily guard, but there is one against which he is powerless, and that is the presence of the ichneumon-fly, which has been described on page 322. It is impossible to obviate or ameliorate this danger, for, even if there were any indications of the parasite's

presence, it could not be extracted without killing the caterpillar. Supposing, however, that the Moth has successfully made its exit from the pupal shell, and has shaken out its wings to the fullest extent, it can be killed by placing it under a glass, and introducing into the same some bruised young laurel-leaves. I find that the most effectual mode of employing the laurel is to take a dozen small leaves, wrap them in muslin, roll them up tightly, and, with two or three blows of a mallet, crush them. The folded muslin can then be slipped under the glass, and in a very short time the Moth quietly expires, so that an absolutely perfect and bright specimen is obtained.

When the insect is quite dead the abdomen should be carefully severed from the body, and the whole of the contents removed by enlarging the little opening which will then be left at its base. The empty abdomen should then be stuffed with cotton wool, care being taken to make it full large in order to allow for shrinking, and when it is dry it may be joined to the thorax without leaving the least trace of the junction. It will be as well to pour a few drops of benzole into the abdomen and also into the thorax, as this precaution will keep off the mites and other creatures that work destruction among dried insects. All large-bodied Moths should be thus treated, and some of them can scarcely be preserved from the unsightly 'grease,' so hated by entomologists, without this useful substance.

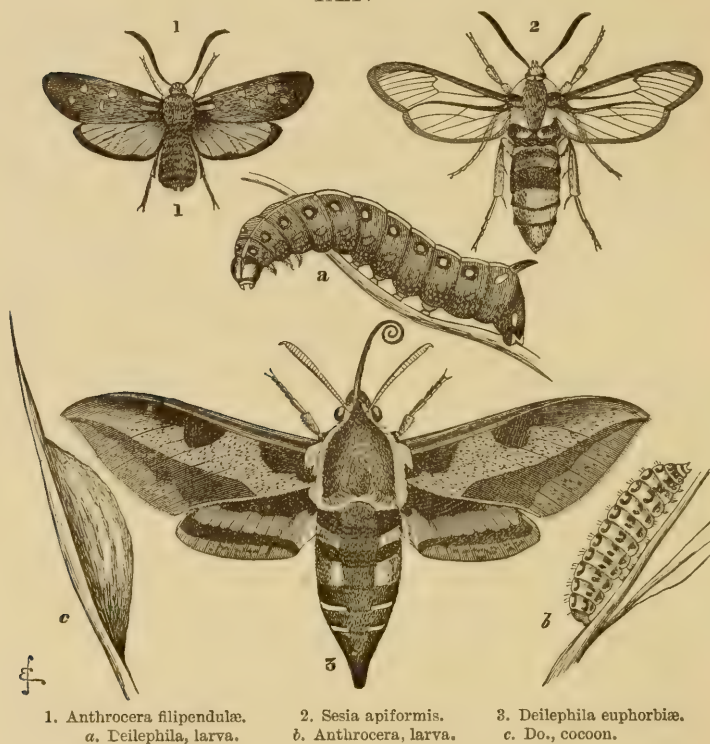
For the purpose of rearing the Moth from the larva, the latter should be obtained about August, as it will then be nearly full-fed, and save a vast amount of trouble in procuring a supply of food. The pupæ themselves may be found under the soil somewhere about September.

ON Woodcut XLIV. Fig. 3, may be seen a figure of the pretty and rare SPURGE HAWK-MOTH (*Deilephila euphorbiæ*). The colour of the upper wings of this insect is grey, with two large olive-brown spots and a diagonal band of the same colour. The lower wings are pink, with a large black patch near the base, a black band nearly parallel with the margin, and a white spot at the anal angle.

Specimens of these Moths have been bred from the caterpillar, but I believe that none have been captured with the net, so that of the many specimens which are found in private

collections nearly all are impostors, having been brought from the Continent, and then sold as genuine British specimens. The professional collectors, who make a living by the sale of insects, are terribly addicted to this trick, and although several of them are good practical naturalists, and have done service to science by discovering the haunts of sundry rare insects, the generality have no more conscience than dog-dealers or pigeon-

XLIV



1. *Anthrocera filipendulæ*.
a. *Deilephila*, larva.

2. *Sesia apiformis*.
b. *Anthrocera*, larva.

3. *Deilephila euphorbiæ*.
c. Do., cocoon.

fanciers, and will invent a history for any insect so that they get a good price for it.

The larva of this Moth is shown at Fig. a of the same Woodcut, and will serve as a good example of the usual form among Hawk-Moth caterpillars, one of the most conspicuous characteristics being the sharply pointed horn at the end of its body. The use of this horn is exceedingly problematical. That it must serve some purpose is evident, but what that purpose

may be is still a question. There are many parts in many animals which seem to serve no purpose, and are evidently the rudiments of some organ which has not been developed. This horn, however, is clearly not within this category, as it is far too large and conspicuous not to be of real importance. At first sight it looks as if it were a weapon, but in the first place, a caterpillar needs no weapon, and in the second case, the horn is incapable of being used as a weapon. Take any Hawk-Moth caterpillar, and if roughly handled it will twist itself about in its efforts to escape, but it will not even attempt to pierce the hand with its horn. And, even if it did wish to do so, the position of the horn is about the worst that could be selected for the purpose. There is no doubt that the formidable-looking horn does deter ignorant people from touching the caterpillar, but I cannot believe that so conspicuous an appendage was given to the larva for so limited a purpose.

All the caterpillars of the Hawk-Moths are prettily coloured, while in some of them the hues may almost be termed brilliant. In the present species the general colour is black, relieved by a vast number of tiny white dots. The head is red, and a red streak runs along the back from the head to the horn, the basal part of which is red, the tip being black. The large spots which are seen on the larva are whitish-grey, and beneath them are smaller spots of the same red as that of the head.

OWING to our limited space, we can but casually glance at some other British Hawk-Moths. There is, for example, the EYED HAWK-MOTH (*Smerinthus ocellatus*), so conspicuous by the large eyelike spots in the middle of the lower wings, and the beautiful pink-brown of the upper wings. The larva of this Moth has a very rough skin, is pale-green in colour, speckled with white, and has seven diagonal stripes on each side of the body. The horn is blue.

Then there is the less conspicuous, but really beautiful, POPLAR HAWK-MOTH (*Smerinthus populi*), so common in the summer, clinging to the bark of trees, to rough posts, and other objects which somewhat resemble it in general colour. It may be known by the mottled brown of the upper wings, with a white spot in the middle, and the warm chestnut at the base of the lower wings. The caterpillar is rough, like that of

the last-mentioned species, and is green sprinkled with yellow, and has seven diagonal yellow stripes on each side. The horn is yellow above and orange beneath. This caterpillar is plentiful, and can be beaten out of the boughs of the Lombardy poplar.

This, by the way, is a simple and very effective plan of securing larvæ, not to mention perfect insects. Nothing more is wanted than an umbrella and a long stick. The umbrella is opened, reversed, and held under the boughs. A smart tap with the stick is sure to dislodge the caterpillars, and send them tumbling into the umbrella, whence they can be transferred to the collecting-box. If bough-beating is to be carried out on a large scale, it is as well to have a sheet held under the branches, and then to ascend the tree, and tap every bough that can be reached. In fact, the poplar can scarcely be treated in any other manner. The umbrella, however, is sufficient for ordinary purposes.

As to the collecting-box which has just been mentioned, I had one which I found extremely useful. It was oval, boldly domed above, and from the middle of the lid projected a tube an inch in height, and three-quarters of an inch in diameter. This was closed with a cork, and through it the caterpillars were introduced into the box. Unless some such plan be adopted, the collector is horribly worried by the caterpillars. There is no difficulty about the first two or three, but when a dozen or more large caterpillars are in the box, it is no easy matter to put in one without three or four pushing their way out, so as to run the risk of being squeezed to death when the lid is closed. By employing the tube and cork, however, no such risk is run, and the box can be quite filled with caterpillars without one even attempting to escape. Some collectors suspend the box over their shoulders, but I always kept it in a pocket, merely fastening it by a string to a buttonhole of the coat, so as to guard against its loss by falling out of the pocket. A few small holes should be bored in the lid for the admission of air. As far as regards size, they should not be larger than pin-holes, and, as far as regards number, six or eight are quite enough.

On lime and elm trees may be found the larva of the LIME HAWK-MOTH (*Smerinthus tilie*). This is easily known by the

very deep scalloping of the fore-wings and the prevalence of olive-green in its colouring. There is some variation in the arrangement of the markings, but the present species is the only one in which the deep olive-green is the leading colour, without any admixture of chestnut or pink. The attitude of the Moth at rest is a very curious one, the under wings being completely concealed beneath the upper pair, the scalloped edges of which, and their mottled surface, have the most astonishing resemblance to a pair of withered leaves.

The larva is pale green, and covered with very small tubercles, each being topped with yellow. Along the sides are seven diagonal stripes of yellow, which are mostly edged with pink. The horn is blue above and yellow beneath. In most parts of England this is a very plentiful insect, and can be either bred or captured without the least difficulty. In my collection, by far the greater number were bred from the caterpillar, and most of them from the full-fed larva, which was captured as it was descending the trunks of trees in search of loose soil in which to bury itself: I have bred considerable numbers of this insect, and have found no difficulty in rearing them—less difficulty, in fact, than I have experienced with any Hawk-Moth, except, perhaps, the Privet Moth, respecting which a few words must presently be said.

PASSING by the CONVULVULUS HAWK-MOTH (*Sphinx convulvuli*), we may pause for a while upon the well-known PRIVET MOTH (*Sphinx ligustri*), so called in honour of the plant on which the larva feeds.

This fine Moth is really one of the commonest of British insects, although seldom seen on account of its nocturnal habits and the limited amount of the plant on which it mostly feeds. The Moth itself is a very handsome one, with a wide expanse of wings, very prettily coloured. The upper wings are very warm brown, mottled and clouded with dark brown; and the lower wings are pink, crossed by three nearly horizontal black bands. The body is pink, banded and striped with black. The caterpillar is a peculiarly handsome one. It is smooth and green, and has on each side seven diagonal stripes, the upper part of each stripe being violet, merging rapidly into white towards the under side.

These caterpillars feed on the common privet, and may

almost always be found in profusion where that plant is present. The best plan for ascertaining the presence or absence of this larva, is to examine the ground beneath the plant. If there be some tiny, oblong bundles of masticated leaves, there is no doubt about the matter, and all that is required is a fair amount of perseverance.

In consequence of the large size of this larva, it has always been rather a pet among entomologists, especially after Newport's splendid dissections. The horn is rather in the way when the caterpillar is laid on its back for dissection, but the various organs are well defined, and give little trouble to the dissector who undertakes the task of tracing the development of each organ, from the larval to the perfect state.

ANOTHER of the Hawk-Moths which deserves a passing notice is the ELEPHANT HAWK-MOTH (*Chærocampa Elpenor*). This species is smaller than those which have been described, and is a very pretty insect. The upper wings are brown-green, shaded diagonally with pink, and the lower wings are pink, with black bases. The thorax and body are coloured like the upper wings, their ground hue is brown with a green gloss, and there are four longitudinal pink stripes upon the thorax, while the sides of the abdomen are pink, and a stripe of the same colour runs down the centre.

The name of Elephant Moth which is given to it is due, not to the perfect insect, but to the larva, which possesses the power of elongating or contracting the three first segments of the body in a manner which is fancifully thought to resemble the proboscis of the elephant. The generic title of *Chærocampa*, or swine-caterpillar, is given to this and other Moths on account of this structure of the larva. On either side of the fourth and fifth segment is a large, black, eye-like mark, which many persons really think to be the eyes of the caterpillar. This larva feeds chiefly on the common willow-herb, and may be found in August. The perfect insect makes its appearance in June.

WE now come to a very common and interesting insect, well known by the popular and appropriate name of HUMMING-BIRD MOTH (*Macroglossa stellatarum*), a figure of which is given on Plate XIV. Fig. 3.



PLATE XIV.
HAWK MOTHS.

1. *Acherontia atropos*.
2. *Acherontia larva*.
3. *Macroglossa stellatarum*.
4. *Macroglossa fuciformis*.

PLANT:—
Potato.



The colours of this insect are anything but brilliant or conspicuous, and yet it is a very pretty Moth. The upper wings are brown, with a few slight black mottlings, and the lower wings are warm chrome yellow, with a narrow edging of black. Beneath, it is coloured much like the lower wings, but the hue is duller. The thorax and abdomen are of the same colour as the upper wings, but the latter has some black and white spots along the sides, which are covered with tufts of black and white hair, which are spread during flight. There is a tuft of black hair at the end of the abdomen.

The caterpillar feeds chiefly on the Bedstraw (*Galium*), and, but for the characteristic horn at the end of the body, would scarcely be taken for the larva of a Hawk-Moth. Its colour is greenish brown, sometimes taking a pink tinge, and there are two lines along the sides, one pink and white, which reaches to the base of the horn, and the other dull brown, beneath the lighter line.

In some places, the Humming-bird Hawk-Moth is exceedingly plentiful, while in others it is quite rare. In Kent, it absolutely swarms in some seasons, but in others only a few are seen. This variability probably depends much on the weather. Last year (1870), when we had a continuance of hot weather in the summer, the Humming-bird Moth appeared in multitudes; whereas, in the corresponding part of the present year (1871) the Moths have been comparatively few and far between.

Sombre as is the colouring of this insect, I really do not know any Moth which is more interesting to the spectator. Fortunately, it flies by day, and, like the lovely bird whose flight it imitates, revels in the hottest sunshine. If, on a hot summer day, the observer will take his stand by a jessamine or other honey-bearing flower, and will quietly wait there, he will assuredly see a Humming-bird Moth before long, should the locality be one which is frequented by this insect. Suddenly, as he is watching a flower, his eyes see a kind of shadowy form flitting in front of the flowers, and his ears are greeted by the hum which accompanies the flight of the Moth. Let him but lift a hand, and the creature is gone—how, or where, it is impossible to say, so amazingly swift is the darting flight.

Still, though it be gone, it will come back again if no move-

ment be made, and, in the same mysterious manner, the Moth is again hovering in front of the flowers. Presently, it selects one of them, and, poising itself within an inch or so of the blossom, its body becomes visible, while its rapidly vibrating wings look like two grey patches of mist on the sides of the motionless body. Presently, a wonderfully long and slender tongue is thrust from the head, plunged deeply into the recesses of the flower, and, thus suspended in mid-air, the insect takes its sweet repast. It is a very remarkable fact that the Humming-birds themselves feed in precisely the same manner.

Indeed, the whole bearing of this insect, including the sound made by its wings, so closely resembles that of the bird, that many persons who have lived in those parts of the world which are favoured by the presence of the Humming-birds, have been so completely deceived by the Moth that they have written letters to newspapers and scientific journals, asserting that humming-birds have at last made their way even to England. There is no better proof of the wonderful resemblance between the bird and the moth than that persons who have been long familiar with the former should mistake the latter for it, and should, moreover, be filled with indignation when practical entomologists ventured to assert that the creature in question was a moth, and not a bird.

The boldness of this Moth is as remarkable as its wariness. It really seems to place such confidence in its magnificent powers of flight that it despises danger. Let a Humming-bird Moth take a fancy to a particular flower, and it will be almost impossible to keep it from that flower. Time after time it may be driven away, for, as I have already mentioned, even the lifting of a hand will startle it. But it continually returns to the same flower, and, sooner or later, takes its fill of the sweet juices. There is scarcely a year wherein this Moth does not find a place in the newspapers under some title or other, some of them not a little ludicrous. Residents in the East Indies may well be pardoned for thinking the Moth to be a veritable humming-bird, but it is not so easy to see why so many persons should assert that it is the locust of Scripture, should mention it under that name to the daily journals, and should answer with contumelious epithets the letters of entomologists who

tell them that locusts and moths are not exactly the same insects.

The enormously long proboscis or tongue, with which it extracts the liquid sweets from the flowers, has obtained for the genus to which this and a few other insects belong, the name of *Macroglossa*, or Long-tongue.

THE next insect on our list is the NARROW-BORDERED BEE HAWK-MOTH (*Macroglossa bombyliiformis*).

According to Mr. Newman, this Moth belongs to the same genus as the last, but some authors place it in a different family. Personally, I agree with Mr. Newman, and so accept his name. This is one of a number of Moths in which the wings are almost wholly denuded of scales, so that they are as transparent as those of the Hymenoptera, to some of which they bear a curious, not to say startling, resemblance.

The present species is called the Bee Hawk-Moth, because, with its translucent wings and hairy body, it bears a strangely close resemblance to a humble-bee. Indeed, so precisely do some of those insects resemble certain bees and wasps that, even to a practised eye, there is some difficulty in distinguishing them when on the wing. The colouring of this species is very simple. The edge of the wings is brown, narrow on the upper wings, and much narrower on the lower pair. The thorax is brown with a very slight tinge of green. The abdomen is dun-colour, crossed by three black bands; one a very broad one at the base of the abdomen, and the two others quite narrow. There are some tufts of stiff black hair on the sides, which it spreads when flying, after the manner of the Humming-bird Moth.

THERE is another allied British Moth belonging to this genus, namely the BROAD-BORDERED BEE HAWK-MOTH (*Macroglossa fuciformis*), which is drawn on Plate XIV. Fig. 4. In this insect the transparent wings are edged with a broad, chestnut border, the upper wings having a brown, diagonal spot in the centre, and a large patch of the very deepest black-green at the base. The thorax and base of the abdomen are brown with a slight green tinge, as is the tip, the remainder being warm chestnut brown. Like the preceding insect, it has

along the sides some black tufts of hair, which it spreads during flight.

This beautiful Moth appears about May; but, as it is a creature of the sun, it is seldom seen, except by experienced entomologists, who know where and when to look for it. Sheltered glades and open spaces in woods are its favourite haunts, but it never appears unless the air be both warm and still. Should the day be cold and dull, and especially if the wind should be in the north-east, the practised insect-hunter knows that he need not trouble himself about this beautiful and capricious insect.

The larva of this species feeds on several plants, among which are mentioned the bedstraws, the common lychnis, and the wood scabious. It is chiefly in consequence of this mode of feeding that these insects have been separated from the next group, which bear a great external resemblance to them, but whose larvæ burrow into wood.

THE next family is that of the Sesiadæ, the members of which have a wonderful resemblance to certain bees, wasps, and flies, their wings being translucent, and their bodies being elongated and narrow, quite unlike those of the preceding naked-winged insects. The antennæ have no feathering, and are very often tipped with a small tuft of hairs. The tongue is not nearly so long as in the preceding genus, and in most cases the end of the abdomen is tipped with a spreading brush of hair.

OUR first example of these remarkable Moths is the POPLAR HORNET CLEAR-WING (*Sesia apiformis*), which is represented on Woodcut XLIV. Fig. 2. This remarkable insect affords one of the best examples of imitation that I know. Only a few hours before writing this account, I was looking over some rather neglected drawers of insects, on the glass of which a slight layer of dust had been allowed to accumulate. I knew that a Hornet Clear-wing was among them, and yet the insect twice escaped observation, so strongly does it resemble the hornet beetle in colour and shape.

The upper wings of this insect are transparent, with a slight yellowish tinge, and a narrow, dark border. The head is yellow, and there is a yellow patch on either side of the brown

thorax. The abdomen is yellow, with a broad dark-brown band near the middle, and a very narrow band of a similar colour nearer the base. The legs are orange-yellow. In fact, the colouring of this Moth is almost identical with that of the hornet, the peculiar rich, warm brown of the markings and the yellow of the ground colour being almost exactly identical in both insects.

The caterpillar of this Moth burrows into the wood of the poplar and aspen, and in its tunnel undergoes all its changes. When the larva is full-fed, it spins for itself a rather tough cocoon, made of small fragments of wood bound together with silk, and the Moth emerges about midsummer. The larva of this species passes two years in the tree before it changes to the pupal state.

To this genus, which contains thirteen British species, belong the lesser Clear-wing Moths, which derive their names from the singular resemblance which they bear to various flies and Hymenoptera. They all have slender bodies, tipped with a spreading brush of hair, and their wings are transparent, with a black edge, black nervures to the lower wings, and the upper wings edged and mostly barred with black, brown, or orange.

The commonest of them is the Currant Clear-wing (*Sesia tipuliformis*), which may be found in the summer-time resting on the leaves of the currant. It bears a remarkable resemblance to a gnat, whence the name *tipuliformis*, i.e. formed like a gnat. There are two longitudinal yellow streaks on the thorax, and three bars of the same hue across the body.

The larva of this Moth lives inside the twigs and young branches of the currant, from which it bores out the pith, and often kills the branch. Indeed, whenever a bough of the currant begins to wither away without any perceptible cause, a larva of this Moth may generally be found within it.

One of these curious Moths takes its name from the ant, another from the chrysis or fire-tail, another from the gall-fly, and so on. None, however, afford such a perfect example of imitation as does the Hornet Clear-wing of the poplar, which would even deceive an entomologist unless examined closely.

THE family of the Zeuzeridæ is remarkable for the fact that the females are furnished with a long and hard ovipositor,

by means of which they can introduce their eggs beneath the bark of the trees on which the caterpillars feed. The tongue and antennæ are short, and the larva is naked, with the exception of a few scattered hairs. There is a peculiarity in the chrysalis, which will presently be described.

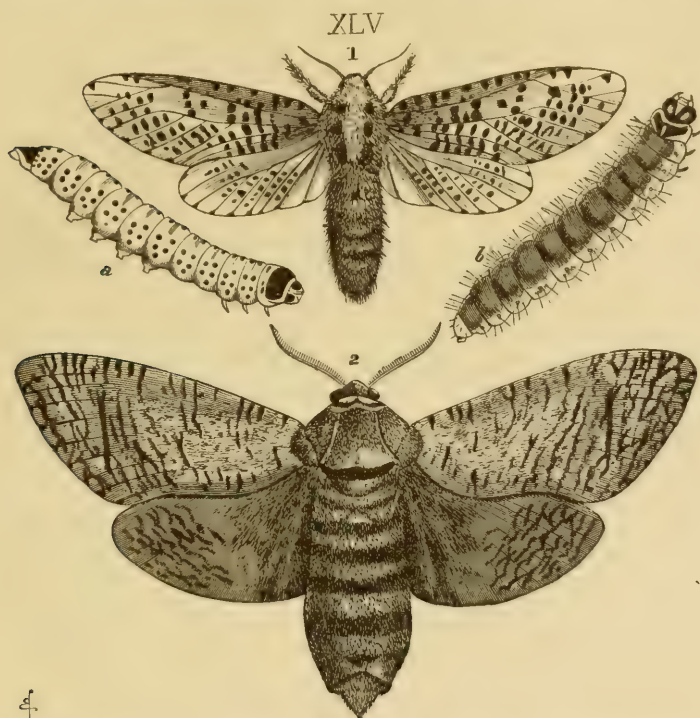
A very characteristic example of this family is given on Woodcut XLV. Fig. 1, the insect being popularly and appropriately called WOOD LEOPARD MOTH (*Zeuzera æsculi*). This is a very pretty moth, though the colours are simply white and black. The white, however, is partially translucent, and the black is in reality the very deepest blue-green. The figure represents the female. The male is coloured in a similar manner, but his antennæ are boldly curved, and adorned for the first half of their length with a deep double comb.

At Fig. *a* is represented the caterpillar of the Wood Leopard, about half-grown. As may be seen by reference to the illustration, it very much resembles the perfect insect in markings, the green colour being white and the spots shining black. Behind the head is a large black plate. This caterpillar burrows into the limbs of many trees, especially fruit trees, but appears to do little, if any, harm to them. Indeed, Mr. Newman states that fruit trees which are pierced by this larva bear even more abundantly than those which are untouched by it.

The perfect insect appears in the middle of summer, and is a common insect, though it will seldom be found except by persons who know where and when to look for it. The female mostly remains near the tree in which she was bred, and may be found at night clinging to the trunk, where she can be detected by the aid of a lantern. The male is much bolder, and flies abroad in search of his mate. He is one of the many Moths that fly towards a light, and can often be taken by the simple process of putting a lamp near an open window. Many entomologists have made quite valuable collections of insects by this one plan.

With respect to this particular Moth, Mr. W. C. Hewitson notices, in 'The Entomologist's Monthly Magazine,' for September 1869, a very curious appearance of this insect. 'A fortnight ago, twelve *Zeuzera æsculi* came down my drawing-room chimney. They were all males. What business they had.

there I cannot say. I looked in vain for a female.' There is some little difference of opinion respecting the generic name of this Moth. Professor Westwood states that the right mode of spelling it is *Zenzera*, that being the original name given to it by Latreille, and that *Zeuzera* is simply the error of the printer, who had mistaken the letter *u* for the *n*, or, perhaps, had turned the *n* upside down. Be this as it may,



1. *Zeuzera æsculi*. 2. *Cossus ligniperda*. a. *Zeuzera*, larva. b. *Cossus*, larva.

the word *Zeuzera* is now so universally acknowledged among entomologists that I have retained it, and simply mention Mr. Westwood's correction.

There is a peculiarity in the structure of the chrysalis of this and other Moths of the family. Each segment is furnished on its edges with a row of little hooks by means of which it can traverse its tunnel nearly as fast as it could while in the caterpillar state. As the pupæ of the Lepido-

ptera generally are quiescent, and few can do more than jerk the tail from side to side when irritated, it is rather startling to see a chrysalis wriggle itself up and down the burrow which it has made while in the caterpillar state.

WE now come to the GOAT MOTH (*Cossus ligniperda*), so-called on account of the very strong odour which is given out by the larva, and bears some resemblance to the powerful scent of the he-goat. A figure of this insect is given on Woodcut XLV. Fig. 2.

The colour of this Moth is nothing more than brown of different shades, arranged as shown in the illustration. As far as the perfect insect goes, there is but little interest about it, but in the larval condition it is peculiarly interesting, were it only for the fact that everything which can do harm contains within itself an element of interest. We will rapidly trace the life of the Goat Moth, from the deposition of the egg to the development of the perfect insect.

It has already been mentioned that the female Moths of this family possess a long ovipositor. With this instrument the female Goat Moth carefully lodges her eggs deeply in the crevices of the bark of some tree, and there leaves them. In process of time they are hatched, and, tiny as they are, soon are able to bore their way into the tree. They spend four years in the body of the tree, apparently never ceasing to eat, and boring their tunnels through and through the solid wood. These tunnels increase in size according to the development of the caterpillar, and, as a great number of larvæ generally inhabit one tree, it is no wonder that so many trees are killed by them.

The number of these destructive creatures that are found in one tree may be imagined from an experiment made by Mr. Douglas. He found an elm lying on the ground, having been blown down in consequence of the galleries of the Goat Moth caterpillar weakening the trunk so much that it could not endure the wind. He cut off a piece of the trunk two feet long, and twenty-three inches in diameter at one end and fifteen at the other. Wishing to place it in a vessel sixteen inches in diameter, he was obliged to cut it to the required size, and in so doing turned out no less than sixty-seven

caterpillars, while the remainder of the block was equally well stocked with these larvæ.

One of these caterpillars, about one-fourth grown, is shown at Fig. *b*, and a curious-looking creature it is. The skin is very smooth and shining, and without hairs, except some stiff bristles which project from each segment. These are not so conspicuous in the larva as in the drawing. The colour is pale mahogany, except the head and a hard plate on the second segment, which are black. The body is rather flattened, the head is wedge-shaped, and furnished with very powerful jaws. When full-grown the caterpillar exceeds three inches in length, and is as thick as a man's finger. The strength of a full-grown larva is enormous, and its powers of forcing its way out of the vessel in which it is confined must be seen to be appreciated. I have kept many of these larvæ, and never felt sure of them. They were continually escaping. Putting them into a wooden box was quite useless, as they ate their way through the side in a very short time. Putting them in a tin box was equally useless unless the cover were tied down, for they had a way of pushing at the lid round the edges, and so gradually opening it sufficiently to permit their escape. Even perforated zinc is not safe from them, for I have known my caterpillars to find out a place where the zinc has been cracked, fix their short and powerful jaws in the holes, and fairly twist down a flap through which they managed to force themselves.

The odour which these creatures give out is equally powerful and enduring, and to many persons is peculiarly hateful. Whether from use or not I cannot say, but I do not find it nearly so offensive as the odour of many other insects, such as the *Dyticus* beetle and the Lace-wing fly. The odour permeates the whole of the tunnels, and for years after they have been deserted the scent is sufficiently strong to denote the inhabitant.

When the larva is full-fed it forms a cocoon made of fragments of gnawed wood and silk. The cocoon is very tough, and will withstand much rough handling. These cocoons are oval, similar in shape at both ends, flexible, and yellow in colour, and are very strongly scented with the odour of the insect which made them. There is considerable variety in the size of the cocoons, and some are barely half as large as others.

The small cocoons seem never to produce Moths, but are infested by an ichneumon-fly, which, fortunately for us, preys on the Goat Moth caterpillar. Not that the large cocoons are free from this parasite, for, as every one knows who has bred them, the large cocoons frequently disappoint the collector, and produce ichneumons instead of Moths. It is a curious fact that the ichneumon itself (*Lampronota setosa*) possesses an odour similar to that of the larva in which it lays its eggs.

In the 'Entomologist' for August 1868, Miss E. Newman mentions that she possesses a Goat Moth cocoon which was made with earth instead of wood-chips, and was discovered in April, in the middle of an arable field. After being removed from the cocoon and placed in a breeding-cage, the larva again burrowed into the earth, and emerged at the end of June, perfect in every respect, but rather smaller than the usual size.

After the larva has lain in its cocoon for some time, it discharges from its mouth a fluid which is contained in two large sacs within the body, and softens the silk so that it can be easily broken. It then throws off the caterpillar skin and becomes a chrysalis, which is at first white and soft, but afterwards hard and brown. The edges of the segments are furnished with little points directed backwards, and by alternately stretching and contracting the abdomen, the pupa forces itself along its larval tunnel until it comes to the end. Just before the final transformation the pupa renews its efforts, and fairly pushes itself through the thin shell of bark that has been allowed to remain by the larva.

It still continues to push its way on until it has forced itself through the opening, as far as the base of the abdomen. After a while the pupal skin splits, and the Moth emerges slowly, climbing up the bark of the tree, and there clinging while it shakes out its wings. The empty pupa skin remains at the entrance of the tunnel, and towards the middle or end of summer, according to the season, plenty of these empty shells may be found projecting from trees that are infested with the Goat Moth larva. The Moth itself can generally be captured upon the bark of the tree in which it has passed its pupal state.

The willow is the tree that is usually infested by this insect, and vast damage is often done by it. On the Kentish marshes near my house are numbers of willow-trees, or rather the

remains of them, which have owed their death to the Goat Moth larva, and from them I have procured larvæ and cocoons in plenty. Other trees, however, are attacked by this destructive insect, especially the elm, and Mr. Newman is of opinion that those trees which are apparently killed by the Scolytus (which has been described on page 186) have received their death-blow from the Goat Moth, and have only been attacked by the Scolytus when dying.

The Moth is a very troublesome one in a cabinet, as it is very liable to the two chief pests of the cabinet, namely, 'grease' and mites. I have known one of these Moths to be completely hollowed by the mites, and to show little signs of injury except the brown powder scattered under the affected insect. As soon as the Moth was taken up its body broke in two, and at least two teaspoonfuls of powder and mites were discharged over the other insects. Consequently it will be found advisable to stuff this Moth, and to put a drop or two of benzole into the cavity.

For further information on this insect, and a full account of its ravages, I refer to an admirable monograph by Mr. Newman in the 'Entomologist' of November 1869.

ON Woodcut XLIV. (page 418) and Fig. 1 is seen a common and very pretty Moth belonging to the family Zygaenidæ. The insects belonging to this family may be distinguished by their very brilliant and boldly contrasted colours, their habit of flying by day, the stout and hairy caterpillar, and the cocoon fastened in an upright position against the stems of grasses. Only one genus inhabits England. The Moth which is given in the illustration is called scientifically *Zygaena* or *Anthrocera filipendulæ*, and is popularly known as the SIX-SPOTTED BURNET. There are four species of Burnet Moth, three of which are so much alike that none but a practised entomologist can distinguish them, especially as the spots, from the number of which they derive their popular name, are almost precisely similar. This very beautiful insect has the upper wings of the deepest possible green, so deep indeed as to appear black unless the light be properly thrown upon it. The lower wings are rich crimson, edged with black. The peculiar form of the antennæ is so well shown in the illustration as to need no description.

The caterpillar, which is drawn at Fig. *b*, feeds on the Bird's-foot trefoil (*Trifolium ornithopodioides*) or the Common Deepwort (*Spiræa filipendula*), from the latter of which the insect derives its specific name. The colour is yellow, with a slight brownish tinge, and it is diversified by a double row of black spots. When the larva is full-fed it climbs up a grass stem, and there spins a very curious cocoon, shaped exactly like a spindle, or, to speak more familiarly, like the wooden 'cats' that boys are apt to make in more profusion than is agreeable to adult pedestrians. These cocoons are pale straw-colour, rather tough, and very firmly fixed to the grass. The cocoon is shown at Fig. *c*. The perfect insect makes its appearance at the beginning of summer, and always flies in the hottest weather, so that the sunbeams play gloriously upon its splendidly coloured wings and body. Cold seems to paralyse the insect, and though on a hot calm day the Moths may be flying in hundreds over the field, a change of wind, bringing with it a blast of cold air, will send them all under cover, so that, though the field be actually studded with their cocoons, not a Moth will be seen.

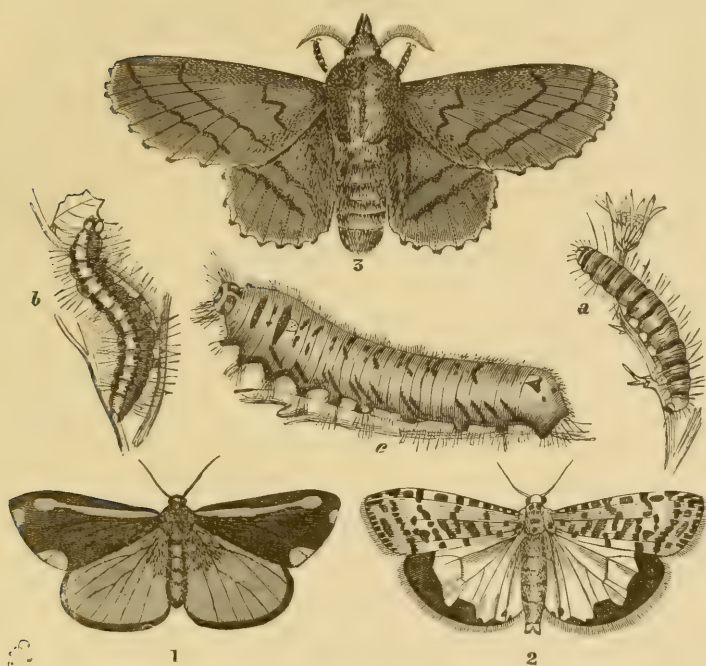
The insect does not appear to travel far, but, like many others, to restrict itself to certain favoured localities. There were one or two fields near Oxford, which absolutely swarmed with these beautiful Moths, while at the distance of half a mile not a Burnet Moth was in sight. Owing to the great similarity of the different species, the entomologist who wishes to make a good collection must catch pretty well every Burnet Moth that he sees. With the exception of the Transparent Burnet (*Zygæna Minos*)—which I believe is an Irish, and not an English insect—it is absolutely impossible to distinguish one species from the other on the wing, and much care is required to separate them even when they are safely in the collecting box. I well remember, when beginning my practical researches into entomology, how puzzled I was with the different species of Burnet Moth, and how difficult it was to believe that they really were different species, and not merely varieties of one species.

PASSING of necessity over many Moths, we come to an insect which is both pretty and interesting. This is the CINNABAR

MOTH (*Callimorpha Jacobææ*), which is represented on Woodcut XLVI. Fig. 1. It is an example of the family Euchelidæ, in which the antennæ are slender and without any fringe. The caterpillar spins a slight web, in which its hairs are scattered, and the pupa is small. The name Euchelidæ is formed from two Greek words, signifying Beautiful Caterpillar, and is given to the genus because the larvæ are all very beautifully coloured.

To me this is one of the most familiar British Moths, being

XLVI

1. *Callimorpha Jacobææ*.2. *Deiopeia pulchella*.3. *Gastropacha quercifolia*.a. *Callimorpha*, larva.b. *Deiopeia*, larva.c. *Gastropacha*, larva.

one of those that attracted me most as a child. At Oxford it is one of the most plentiful of insects, flying about so abundantly in the gardens that I always had—and still retain—a childish notion that it was the blossom of a scarlet-runner gifted with the power of flight. Common as it is in some places, it really is scarce in others. For example, so practised an entomologist as

the Rev. J. Greene states that he has only taken one specimen of the Cinnabar Moth in England, though he did find the pupa. This part of Kent seems to be objectionable to the Cinnabar Moth, though the ragwort (*Senecio Jacobea*), on which it feeds, grows profusely in the neighbourhood. In and near Oxford there is scarcely a plant of ragwort on which the pretty caterpillar, with its orange body and black rings, may not be found, or which has not some of the shining brown pupæ near its roots. This larva is shown at Fig. *a*. It has a habit of coiling itself into a ring when alarmed, and falling to the ground.

The colouring of the Cinnabar Moth is very bold, and is easily described. The upper wings are very deep olive-brown, looking almost black by the contrast with the brilliant crimson stripe near the costal margin, and the two crimson spots near the hind margin. The lower wings are wholly crimson, slightly paler than that on the upper wings, and are edged with a narrow border of olive-brown. It is remarkable that the upper and under surfaces of this insect are exactly alike, except that the under surface is slightly paler than the upper. The popular name of Cinnabar Moth is given to the insect on account of the cinnabar-crimson colour of its wings.

On Woodcut XLVI. Fig. 2 is drawn a very pretty and very scarce Moth, called, from its colouring, the CRIMSON SPECKLED (*Deiopeia pulchella*). The upper wings of this moth are white, and they are covered with a number of square spots, seeming at first sight to be scattered promiscuously over the wings, but having a tolerably regular arrangement. These spots are scarlet and black, and are set in transverse rows, the black and scarlet running alternately. The lower wings are white, with a slight clouding of black towards the margin. The pretty caterpillar is leaden blue, with a white streak along the back, and a row of scarlet spots along each side.

This is one of the rarest of genuine British Moths, and, if any of my readers should be requested to purchase a 'warranted British Crimson Speckled,' they may be quite certain that the vendor is a conscious impostor, inasmuch as so valuable a prize would not be hawked about for sale.

Mr. Newman's quaint and true remarks respecting certain butterflies will apply to this and other rare moths:—'They are to be purchased in abundance at 1*d.*, 2*d.*, or 3*d.* each, neither

species being uncommon on the Continent. Supposing the purchaser to be fastidious as to his collection being purely British, he may obtain a warranty with any individual specimen he is selecting, by paying twenty or thirty shillings additional. The specimen then becomes "British," just as a wealthy tradesman becomes an esquire by paying for armorial bearings which some ingenious manufacturer professes to find in Herald's College. I prefer dispensing with warranty, as too expensive a luxury.'

A really genuine British specimen is now before me. It was caught by a young lady close to my house at Belvedere, Kent, on Sept. 11, 1871, and brought to me while the wings were still flexible.

There are only three British species of this beautiful family. Two have been described, and the third is the handsomest of them all. This is the CRIMSON TIGER (*Callimorpha Dominula*), which, fortunately for entomologists, is not very scarce, though it is decidedly local. The upper wings are dark olive-brown, with a gloss of the richest and deepest green, and on them are a number of bold white spots, variable in number and size, but always tending to orange towards the middle of the wing. The lower wings are crimson, with several black patches.

The caterpillar of this lovely Moth is blue-black, with a rather broad yellow stripe down the middle of the back, and a narrow stripe on either side. It feeds on the common Hound's-tongue (*Cynoglossum officinale*), which grows among valleys and on road-sides. Wherever this plant, with its downy, dark-green leaves and crimson flower, grows in plenty, there is sure to be a favourable locality for the caterpillar of the Crimson Tiger; if not for the Moth itself.

ANOTHER family now comes before us — the Cheloniidæ, popularly known as Tiger-Moths. They have the antennæ more or less deeply fringed in the male, and the caterpillar is very hairy, coiling itself into a ring when alarmed. Before it changes into the pupal state, it spins a very loose web mixed profusely with its hairs.

The best known of these insects is shown on Plate XV. Fig. 1, and may be reckoned as the type of the family. It is the COMMON TIGER-MOTH (*Chelonia* or *Arctia caja*), so called

on account of the bold cream and black markings of its upper wings. The lower wings are red, with some large black spots glossed with blue. The body is red, barred with black. This is a most variable insect, the number, size, shape, and tint differing in a most bewildering manner. But however variable it may be, there is never any possibility of mistaking it.

It is one of the commonest of British insects, and towards the end of summer the Moth is quite plentiful. It is wonderfully quick of foot, and, as it runs with closed wings among the herbage, has a most curious resemblance to a small mouse.

The larva is covered with long, brown, stiff hairs, and is popularly known by the name of the Woolly Bear. It feeds principally on the common dead nettle, but is not in the least particular as to its food, and, being very hardy, is an admirable subject for experiments in Moth-breeding. Personally I have a sort of respect for this larva, as being the first caterpillar that I ever dissected, and consequently the first creature that let me into the secrets of insect anatomy. When full-fed, the caterpillar spins a slight hammock, woven so loosely that the form of the enclosed pupa can be seen through its meshes, and in this hammock it remains until the perfect insect is developed.

PASSING by one or two well-known insects for which we have no space, such as the Ermines, the Brown-tail, the Golden-tail, the Gipsy, we come to the BLACK ARCHES (*Liparis monacha*), the female of which is shown on Woodcut XLVII. Fig. 2. In the whole of this family white is the prevailing colour, if colour it can be termed, though in several instances the female is nearly white, while the male has some more pronounced hue. In the preliminary stages of existence, not only the larvæ but the pupæ are covered with hair.

The Black Arches Moth derives its popular name from the peculiar colouring of the wings. The upper wings are white, and covered with a vast number of black, arch-like marks, rather variable in size. In some specimens, for example, the markings are quite narrow, and look as if they had been drawn with a very fine camel's-hair brush on a satiny-white ground. In others, the marks are so broad that black seems to be the prevailing colour, and that the title of White Arches would be really the most appropriate one. The male is much smaller

than the female, and his colours, though brighter and more compressed, are sufficiently similar to those of the female to show that they both belong to one species. Moreover, his antennæ are deeply and doubly feathered, and his body is pink, with three rows of black spots on it over the middle, and one on either side.



1. *Pygæra bucephala*. 2. *Liparis* or *Psilura monacha*. 3. *Orgyia antiqua*, male.
4. *Orgyia antiqua*, female. a. *Pygæra bucephala*, larva. b. *Orgyia antiqua*, larva.

The larva is one of the many oak-feeders, and the perfect insect appears in the autumn. Those who wish for good specimens of this pretty Moth ought to rear it from the caterpillar, which can be obtained in full condition towards the end of June, by beating the oak, the birch, and one or two other trees.

NEXT comes that interesting insect, the common VAPOURER MOTH (*Orgyia antiqua*), the male of which is represented on Woodcut XLVII. Fig. 3.

This is rather a pretty Moth, though the colours are anything but brilliant. The wings are warm chestnut, the upper pair having some waved transverse marks, as shown in the illustration, and a bold, nearly semilunar white spot at the anal angle.

He is very common, and is one of the few *Lepidoptera*—except perhaps the Clothes-Moth, which is more plentiful than desired—that is very common in London, and may be found even in the dingiest and smokiest portions, provided that trees or shrubs grow in it. I should think that if even Leicester Square could produce a tree, it would also produce the Vapourer Moth. He is one of the day-flying moths, and seems to revel in the blazing sunbeams, flitting about with rapid, and apparently uncertain wing, upon the hottest days of summer.

There is, however, nothing uncertain about his flight, for he has a very definite object, namely, to seek a mate. Considering the kind of creature she is, and her peculiar habits, one is led to marvel, in the first place, how the active, prettily-coloured male Vapourer can find anything attractive in the female, who is about as plain—not to say, plebeian—an insect as can well be imagined. A figure of the female is given on Woodcut XLVII. Fig. 4, and the reader will see that a less attractive and more commonplace creature can hardly be seen. She has no wings to speak of, these organs being quite undeveloped and simply rudimentary, so that she could not fly one single inch. Her body is large, thick, soft, and covered with grey down, slightly darker at the edge of each segment.

This curious creature never wanders from the spot where she happens to have passed into the pupal state. Like the male, she has, when a full-fed caterpillar, spun a silken web, within which she has undergone her transformation.

The male has done the same, but when he has assumed the perfect form, he shakes out his pretty wings, takes to the air, and gaily sets out, like 'Cælebs,' in search of a wife. She, on the other hand, never travels at all. Where she was reared, there she lives, there she is mated, there she provides a fresh brood, and there she dies, fulfilling the duties of her life within very narrow bounds. Her eggs are laid upon the silken web which she herself spun as a caterpillar, and from those eggs are hatched a brood of tiny larvæ, each of which is intended to follow in the track of its parents.

So plentiful are these egg-groups that, were it not for the presence of sundry little birds, which find much of their winter's nourishment in the eggs of various *Lepidoptera*, we should be soon overrun with Vapourer Moths, and our trees and hedges would suffer sadly. The female moths themselves, being utterly unable to escape, and not seeming able even to crawl beyond the limits of the pupal web, also fall victims to the birds in no small number.

The caterpillar is shown at Fig. *b* of the same Woodcut, and is a very pretty one. Its colours are exceedingly variable, but it is always furnished with a brush-like tuft of yellow hairs on the back of the fifth, sixth, seventh, and eighth segments, two long black tufts on the second segment, directed forwards, and a single similar tuft on the last segment but one, directed backwards. There is scarcely a tree or shrub on which this strange-looking caterpillar will not feed.

ON Plate XV. Fig. 2 is seen the male OAK-EGGAR MOTH (*Bombyx* or *Lasiocampa quercûs*). This well-known insect belongs to another family, the Bombycidae, in which the caterpillars are mostly hairy, the pupa smooth, and the perfect insect large and stout-bodied, and coloured with various shades of brown or grey. The smooth pupa at once distinguishes this insect from the last.

Although the colours of this insect are not brilliant, the Moth is a very handsome one, the simple colouring of its wings being well contrasted. The male has the wings rich warm chestnut, and across each of them is drawn a slightly waved yellowish band. Rather towards the base of the disc there is a white spot very clearly marked. His antennæ are deeply and doubly feathered. The female is much larger, but not nearly so handsome, the colour being mostly yellow with the band pale and undefined.

The chief interest of this moth lies in its preparatory stages. The caterpillar is a very fine one, and remarkable for its change in appearance when it bends its body. The ground colour of this larva is deep velvety-black, very thickly covered with rich brown hairs. When the caterpillar is straight it appears to be uniformly brown, but when it curves the body, the velvet-black appears between the segments and gives a very bold and effec-

tive appearance to the hitherto plain caterpillar. There are other marks, but these velvet rings are amply sufficient for identification.

It is very plentiful in some places, and though it is a very general feeder, eating almost every non-poisonous herb or leaf that may be given to it, the larva has fancies of its own and prefers one place to another, though apparently both localities are exactly alike in every respect. There was, for example, a portion of a hedge, about half a mile in length, to which I always resorted when in want of an Oak-eggar caterpillar. I generally used the sweep-net for this purpose, passing it very gently through the herbage, and was sure to be rewarded with success.

This caterpillar, especially when nearly full-grown, is a troublesome being in a collecting-box, and I do not know of any which has a more unpleasant knack of pushing its way out of the box whenever the lid is removed for the admission of a new inmate. In fact, unless the collector should be provided with a box such as has been described on page 420, he will find that the Oak-eggar caterpillars are greatly trying to the temper, and may perchance get themselves crushed while trying to make their escape.

When full-fed, the caterpillar spins a cocoon of wonderful toughness and strength. It is shaped very much like an egg (whence the popular name of Oak-eggar), and is brown and very close in texture. About the end of summer or beginning of autumn, the Moth breaks its way through the cocoon and appears in the perfect state. It mostly flies at night, but I have seen it on the wing at mid-day.

ON Woodcut XLVI. Fig. 3 is seen the well-known LAPPET MOTH (*Gastropacha* or *Lasiocampa quercifolia*). This curious insect derives its popular and scientific names from two totally different attributes. The name *quercifolia*, or 'oak-leaf,' is given to it on account of the astonishing resemblance which it bears, when its wings are closed, to a brown withered oak-leaf.

On reference to the illustration, the reader will see that the edges of the wings are deeply scalloped, just as are those of the oak-leaf. The colour of the Moth is warm chestnut-brown,

and on the upper wings are three dark bands, scalloped in conformity with the margins. There is also a black dot on the middle of the wing. The lower wings are marked somewhat in the same manner, save that the dark bands are less defined. There is no difference in colour between the sexes, which can, however, be at once distinguished by a glance at the antennæ, which are doubly feathered in the male and thread-like in the female. For a short time after it escapes from the pupal envelope, the surface of the Moth is remarkable for a beautiful blue or purple gloss, which has been well compared to the bloom on a plum. It is quite as fragile as that bloom, and even more fugitive, for it vanishes in a few hours, no matter what care may be taken of the specimen.

Whether this union of colouring and outline be intended for the purpose of concealment is at present an open question and likely to continue so. Suffice it to say that it certainly does serve that purpose very effectually. The reader must have observed that the oak-tree, late to develop new leaves, is equally late in parting with the old foliage, the old leaves clinging tightly to the branches until actually pushed off by the new generation. Now, if two oak-twigs were put side by side, on one of which were two or three withered oak-leaves, and on the other a leaf and a Lappet Moth, it would be almost impossible to distinguish the animal from the vegetable, except by close examination.

So much for the name of *quercifolia*, and we come to the term Lappet. This name is given to the insect on account of the construction of the caterpillar, which grows to a considerable size, and is easily recognisable. Along each side is a row of fleshy appendages, or 'lappets,' those of the second, third, and fourth segments being the largest. The colour of the larva is variable, but it may always be known by the peculiar lappets, the hump on the twelfth segment, and the two stripes of deep velvety-purple between the second and third, and third and fourth segments. Willow and blackthorn are its favourite food.

One of these larvæ is shown on Woodcut XLVI. Fig. c., as it appears when almost half-grown.

When full-fed it spins for itself a rather large cocoon, looser in texture and darker in colour than the firm, egg-like habita-

tion of the preceding insect. The pupa is blacker than that of the Oak-eggar. The perfect insect appears about the beginning of summer. Large and strong as this Moth appears to be, the plumage is in reality exceedingly delicate, and sure to be rubbed and damaged if the insect be caught in a net. Rearing it from the caterpillar, or pupa—the latter plan generally producing the finest specimens—will generally ensure perfect insects, one of which should be carefully set as it appears when at rest.

Our last example of the Nocturni is the beautiful EMPEROR MOTH (*Saturnia Carpini* or *pavonia-minor*), the female of which is represented on Plate XV. Fig. 3. The general appearance of both sexes is very similar, except that the colours of the male are much more brilliant than those of the female. As she is figured in the Plate, we will describe her first. The colour and markings are so conspicuous that there is no necessity for very minute detail. The wings are pearly-grey, mottled and striped with brown, dark-grey, and chestnut. On each of the wings there is an eye-like spot, black in the middle, and surrounded with consecutive rings of warm buff and black, variegated with dark-crimson and violet.

The male has the upper wings of deeper and richer hues than those of his mate, and the under wings are warm ochreous orange, mottled and striped as in the female. The eye-like spots are similar in both sexes. The male is also distinguished by the antennæ, which are shorter than those of the female, and have a beautiful double feathering, widest in the middle, and decreasing towards the base and tip, so as to give the whole organ an outline much resembling that of the laurel leaf.

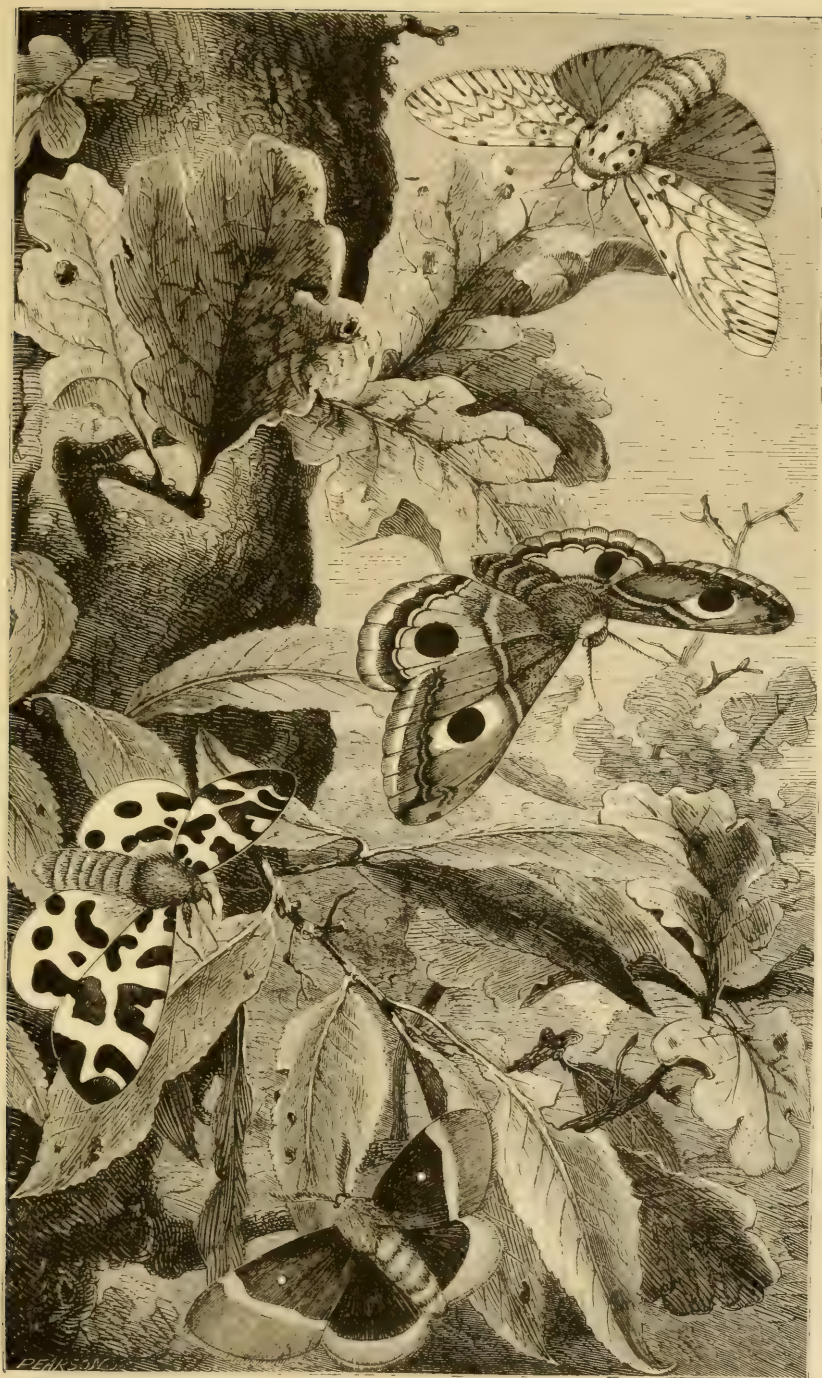
The caterpillar is quite as conspicuous as the perfect insect. It is beautiful leafy-green in colour, and the segments are marked so very distinctly that they look as if a number of threads had been tied tightly round the insect at the junctures of the segments. On each segment are a number of pink tubercles, each tubercle bearing a small brush of black bristles, and being surrounded with a ring of black. It feeds on a variety of plants, but I have found it more frequently on heath than on any other plant.

PLATE XV.
NIGHT FLIERS.

1. *Chelonia caja*.
2. *Lasiocampa quercus*.
3. *Saturnia carpini*.
4. *Dicranura vinula*.

PLANTS:—

Oak and Willow.



When it is full-fed, the larva spins a light-brown cocoon among its food, and the perfect insect appears in the middle of spring.

This cocoon is one of the most remarkable and interesting of insect habitations. Externally it is a simple brown, oval structure, more pointed at one end than the other, and having an outline much resembling that of a balloon. If it be carefully opened, and cut in two longitudinally, a most remarkable structure is seen. The smaller and pointed end is double, and within the outer case is a ring of short and stiff threads, looking much like bristles, their free ends directed towards the mouth of the cocoon, which is allowed to remain open. As these bristle-like threads follow the curve of the wall of the cocoon, it is evident that their ends must converge so as to close the opening against the entry of any insect foe, while they yield to the pressure of any creature within.

In consequence of this arrangement, the pupa remains securely shut up in its habitation, and, when the time comes for its assumption of the perfect state, the newly developed Moth creeps easily out of the cocoon, the guardian threads of which yield to its passage, and then close again, so that to all appearance, the cocoon looks just as it did when it contained the chrysalis. As the caterpillar is a tolerably hardy one, there is no difficulty in obtaining the beautiful cocoons.

CHAPTER III.

GEOMETRÆ.

THE large and important group of *GEOMETRÆ*, or *LOOPERS*, now come before us. These appropriate terms are applied to the *Moths* on account of the mode of progression adopted by the larva. The caterpillars are so constructed that they cannot walk after the usual fashion of such beings. The reader will remember that the caterpillars hitherto mentioned have a number of false legs, or claspers arranged on the under side of the body, in addition to the six true legs which are situated on that part of the body which will afterwards become the thorax of the perfect insect. Most caterpillars have five pairs of these claspers, but the *Geometra* larvæ have only two pairs, which are set closely together at the very end of the body. The caterpillar is therefore obliged to adopt a peculiar mode of progression.

When it wishes to move, it clings very firmly with its true legs, loosens the grasp of its claspers, and draws them close to the legs, so that its body is brought into an arch or loop. The claspers then fix themselves tightly to the object on which the caterpillar is moving, and the body is stretched out in order to find a fresh foothold for the legs. Thus, the caterpillar proceeds by bringing its body into the loop-like form and stretching it out for another hold. This may seem an awkward mode of progression, but it is nothing of the kind. There is even a sort of grace about the movement, and the caterpillar gets along at a wonderful pace, forming its successive loops with a rapidity that seems almost incredible.

The muscular strength of these caterpillars is wonderful. Most of us have seen acrobats fix their feet to an upright pole, or grasp it with their hands, and stretch out their bodies horizontally. This attitude requires great muscular powers

very carefully applied, as those readers well know who have practically studied gymnastics. The leverage is so great that the strongest and most accomplished gymnast cannot maintain his position for any length of time, the attitude requiring the strongest possible strain on the muscles. Yet this attitude is not only easy to the Geometræ, but appears in some cases to be the chosen attitude of rest.

Several of these larvæ pass a large portion of their time stretched out at full length from the twig on which they are clinging. In this attitude they so exactly resemble twigs, that the sharpest eye can scarcely detect them, and even the most experienced entomologists are often deceived, taking veritable twigs for caterpillars, and caterpillars for twigs. None of the caterpillars are hairy, and their smooth bodies, often furnished with blunt spikes or humps, bear the most curious resemblance to the smooth-barked, bud-bearing twigs of the trees on which they live. Such caterpillars can be at once recognised as belonging to the Geometræ, and every entomologist knows that if he should find a looping caterpillar, and rear it, the result will certainly be a Geometra Moth of some kind.

In the perfect state it is not so easy to distinguish the Geometræ, though there is a certain and almost indescribable aspect about them that a practised entomologist rarely fails to detect, even though the species be new to him. We will now proceed to examine some of the most characteristic of these Moths in detail.

THE first family of the Geometræ is called Urapterydæ, or Wing-tail Moths, because in them the hinder wings are drawn out into long projections, popularly called 'tails.' In England we have but one insect belonging to this family, the beautiful, though pale-coloured, SWALLOW-TAILED MOTH (*Urapteryx sambucata*). The generic name is spelt in various ways, some writers wishing exactly to represent the Greek letters of which it is composed, and others following the conventional form which is generally in use. If the precisians are to be followed, the word ought to be spelled Ourapteryx.

There is no difficulty in recognising this Moth, the colour and shape being so decided. Both pairs of wings are delicate yellow, and the upper pair are crossed by two narrow brown

stripes, which run from the upper to the lower margin. These stripes are very clear and well-defined, but besides there are a vast number of very tiny streaks of a similar colour, which look as if they had been drawn in water-colours with the very finest of brushes, and then damped so as to blur their edges. The hind wings have only one streak, which runs obliquely towards the anal angle, and, when the wings are spread, looks as if it were a continuation of the first stripe on the upper wings. The shape of the Moth almost exactly resembles that of the Brimstone Butterfly, described on page 393.

The larva affords an admirable example of the twig-resembling caterpillars. It is exceedingly variable in colour, but is always some shade of brown. It has seven bud-like humps, and a few pale stripes along the sides. It is a very general feeder, and may be found on a considerable number of trees and plants. It is quite common, and but for its curious form would certainly be found much more frequently than is the case. The perfect insect appears about July, and can be beaten out of bushes and hedges. Though the wings are large, they are thin and not very powerful, so that there is no difficulty in capturing the insect.

NEXT comes the family of the Ennomidæ, popularly called the Thorns, containing nearly thirty species, two of which we will select for examination. In this family the hind wings are not tailed. Our first example is the BRIMSTONE MOTH (*Rumia crataegata*), which is shown on Woodcut XLVIII. Fig. 3.

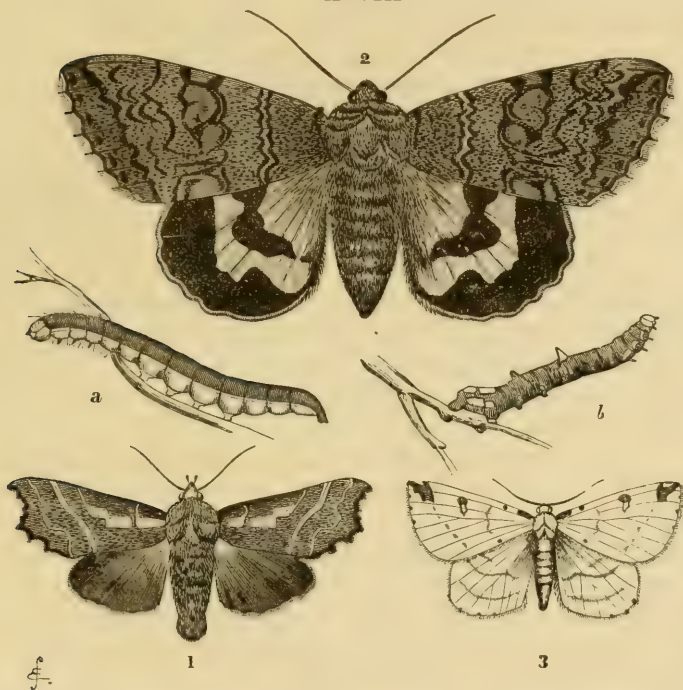
This very plentiful Moth is of a bright sulphur yellow, with a few irregular streaks, and several ruddy chestnut spots on the edge of the upper wings.

The caterpillar has three humps, and possesses four pairs of claspers instead of two. The first and second pairs are, however, not used for progression. This larva is shown at Fig. 6, and gives a good idea of the general aspect of a Geometra larva when the body is stretched out at full length. It feeds both on the blackthorn and whitethorn, and when full-fed spins a thick cocoon close to the ground, and sometimes on it. The Moth may be found throughout the summer, as may the caterpillar.

OUR next example is the OAK BEAUTY (*Amphyclasis prodromaria*), which is shown on Woodcut XLIX. Fig. 1.

Although the colours of this insect are nothing but various shades of black, grey, and white, it is a very pretty Moth. The ground colour of the wings is greyish-white, and across the upper pair are drawn two irregular broad bands of a rich brown colour, edged with black. The dots and speckles which

XLVIII



1. *Gonepteryx libatrix*. 2. *Catocala nupta*. 3. *Rumia crataegata*.
a. *Gonepteryx*, larva. b. *Rumia crataegata*, larva.

are so profusely scattered over the wings are also black. The back of the thorax is brown, the sides grey, and the head white. The antennæ of the female are thread-like, and those of the male are feathered. The caterpillar feeds on the oak and birch, and the Moth is developed in the spring. This caterpillar is shown on the same Woodcut, Fig. a, as it appears when full-fed. Its colour is brown, mottled with white, and the little projections on the back are reddish.

ON Plate XVI. Fig. 4, is shown one of the prettiest of the Geometræ, the LARGE EMERALD (*Geometra papilionaria*), belonging to the family of the Geometridæ.

There is little need to describe the colouring of this beautiful Moth, further than to say that the wings are rather pale leaf-green, and the scalloped markings and dots are white. The head and thorax are green, and the body is greyish-white. The sexes can be distinguished by the antennæ, those of the male being feathered, and those of the female, as shown in the illustration, simple and thread-like. Both the antennæ and the fore legs are whitish. The name *papilionaria* is given to it because it has a sort of butterfly appearance about it. This is a tolerably common Moth, and is mostly found in woods and copses, where it can be taken by beating the bushes. The caterpillar is green, like the perfect insect, and has many humps. It feeds chiefly on the hazel, but may be found on other trees.

PASSING, of necessity, over many of the Geometræ, we come to that very familiar insect, the CURRANT MOTH (*Abraxas grossulariata*), which is shown on Plate XVI. Fig. 5. In consequence of its boldly contrasted markings, it is sometimes called the MAGPIE MOTH.

This is invariably one of the first Moths of the young collector's cabinet, and its larva is perhaps the best known of the Geometræ.

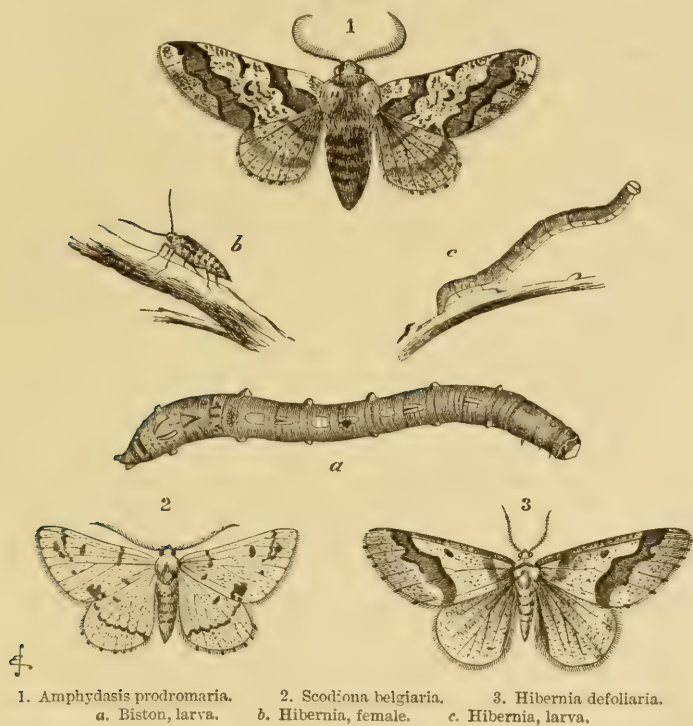
The colour of the wings is white, with a yellow patch at the base of the upper wings, and a rather curved band of a similar colour rather beyond the middle. Upon both wings are a number of deep black spots and blotches, varying greatly in different specimens. Sometimes the black spots are so large that they unite with each other, and make the Moth look as if it were black and yellow. Sometimes the reverse takes place, and the insect is almost entirely white and yellow, with a few pale and uncertain markings of a darker colour, while in many specimens there is a decided preponderance either of the light or the dark portions of the wings. The antennæ of the female are thread-like, and those of the male very slightly, but decidedly, feathered.

This Moth is one of the partial day-fliers, and may be captured in any numbers in gardens where the gooseberry or black-

currant is grown. The insect is a very bold one, and while it is engaged in depositing its eggs, may be picked up with the fingers without much difficulty.

The larva, which is represented on Plate XVI. Fig. 6, is coloured very much like the perfect insect. Being so common, I have been accustomed to watch it from childhood, and have much to say on the subject. But Mr. Newman has so com-

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pletely made it his own that I can do no better than give his own spirited words:—

‘I have seen the females of this species busily engaged in oviposition, not only in the evening, but in the middle of a warm summer’s-day, depositing a single egg on a leaf of gooseberry or black-currant, and then flying off to another. I once watched ten females simultaneously occupied in this manner along a garden wall less than eighty yards in length.

‘Like the eggs of most diurnal Lepidoptera, they remain but

a short time before hatching. The young caterpillar feeds for two, three, or four weeks, rarely longer, and then spins together the edges of a gooseberry leaf, having first taken the precaution of making the leaf fast to its twig by numerous silken cables, which prevent the possibility of its falling when dehiscence takes place in the autumn. In the little cradle thus fabricated the infant caterpillar sleeps as securely as the sailor in his hammock. Snow-storms and wintry winds are matters of indifference to him, but no sooner have the gooseberry bushes begun to assume their livery of green in the spring, than instinct informs him that food is preparing to satisfy his appetite, so he cuts an opening in his pensile cradle, emerges, and begins to eat.

‘The full-fed caterpillar commonly rests in a straight posture, lying parallel with the branch; but when annoyed, he elevates his back, and tucks in his head until it is brought into contact with the abdominal claspers. If the annoyance be continued, he drops from his food, hanging by a thread, and rarely falling to the ground; but when this is the case, he is bent double, and remains a long time in that posture.’

In spite of the very conspicuous colouring of this caterpillar, it is not eaten by birds, seeming to be distasteful to them. It is also distasteful to toads. If one of these larvæ be placed before a toad, it will be snapped up as soon as it moves, but will at once be rejected, the toad moving off as if disgusted with a creature on which it hoped to feed. The colour of this larva is creamy white, spotted and striped with orange, and having a number of bold black spots and stripes, as seen in the illustration.

The pupa is smooth and black, with a slight tinge of red, banded with yellow, so that the caterpillar, the pupa, and the perfect insect have all the same colouring. The Moth appears in the middle of summer.

THE family of the Hybernidæ is represented by the MOTTLED UMBER MOTH (*Hibernia defoliaria*), the male of which is shown on Woodcut XLIX. Fig. 3.

The colour of the upper wings is very pale brown, across which are drawn two bold brown bands, as seen in the illustration. The under wings are paler brown than the upper, and are sprinkled



PLATE XVI.
GEOMETERS AND NOCTUÆ.

1. *Agrotis segetum*.
2. *Agrotis larva*.
3. *Xanthia flavago*.
4. *Geometra papilionaria*.
5. *Abraxas grossulariata*.
6. *Abraxas grossulariata*, larva.

PLANTS :—

Currant and Strawberry.



with very tiny black dots. It is an exceedingly variable insect, and there is one variety which now and then occurs in which the brown bands are absent and the whole of the wings is covered with the little black dots. There is no difficulty in distinguishing the female from the male, as may be seen by referring to Fig. *b* in the same Woodcut. The wings are reduced to the merest rudiments, and are not only useless for flight, but absolutely useless for any purpose whatever. Like those of the ostrich and emeu, they are inefficient as wings. But the two birds which have been mentioned are exceedingly swift of foot, and the wings, though they are not used for flight, do at least assist them in running. But the female Mottled Umber is by no means swift of foot, and indeed a distance of six inches is quite a journey to her. The body of the female is warm brown in colour, and on each segment are two conspicuous black spots. This larva is shown at Fig. *c* in the same Woodcut.

The larva is one of those which are furnished with a spinning apparatus, and use it for defensive purposes.

I may here remark that, in all silk-spinning caterpillars, the machinery is the same, though the length, quantity, and quality of the silk differ greatly. Along each side of the body, and closely pressed against the digestive organs, grows the silk-vessel. This is a tube of greater or less capacity according to the needs of the insect, in which is secreted the peculiar substance which is known as silk. Each of these tubes ends in a very slender outlet, scarcely as thick as a human hair, and the two outlets unite in an instrument which very much resembles the barrels of a double-barrelled pistol. Through these tubes or barrels the gummy secretion is forced, and hardens as soon as it comes in contact with the atmosphere.

Those larvæ in which the supply of this secretion is small are very chary of it, and only use it for the purpose of spinning the cocoon or hammock in which the caterpillar changes to the pupal and perfect states. Those, however, in which the supply is more abundant employ it in various ways, and are often indebted to it for their escape from many foes. Whatever they may be doing, or wherever they may move, they always draw with them their silken thread, one end of which is attached to the leaf or branch on which they are walking, so

that, like Goldsmith's Traveller, they 'drag at each remove a lengthening chain.' If they be alarmed in any way, they at once drop towards the ground, supported by their thread. Generally, they drop only a few inches; but if the alarm continue, they drop more and more, until they reach the ground, where they lie until they are assured of safety. They climb up again rather slowly, but steadily, using their legs for the purpose, and packing up the line into a series of loops as they proceed.

ON Woodcut XLIX. Fig. 2, is drawn the Moth which is properly called the GREY SCALLOPED BAR (*Scodiona belgiaria*), which is an example of the family Fidoniidæ.

In this insect there is a very marked distinction between the sexes. In the male, the upper wings are greyish-white, and covered with a number of black marks, whose shape and number can be seen by reference to the illustration. The female is blackish-grey instead of white, but the black markings are nearly the same. In the male the antennæ are feathered, and in the female they are simple and thread-like.

The larva of this Moth feeds on the common ling (*Colluna vulgaris*), which is so much used for thatching, for rude but strong ropes, for broom making, and for a good yellow dye. Like many other larvæ, if alarmed, it falls at once to the ground, coils itself in a ring, and will lie motionless for hours together. Its colour is dull-brown, with a few grey mottlings, and one or two small streaks of white. It is full-fed at the beginning of May, and the perfect insect appears at the end of the same month.

QUIET and simple-looking as is the WINTER MOTH (*Cheimatobia brumata*), which is represented on Woodcut L. Fig. 1, there are few of our British insects which do more harm to the trees, especially the fruit-trees.

The colour of the upper wings is greyish-brown, more or less tinged with yellow, and marked with a few waved transverse bars of a darker tint. The lower wings are much the same colour, but almost without markings. Owing to its peculiar habits, this is one of our most familiar Moths. It appears in the cold months of November and December, and on a sunshiny

day may be seen flitting along the hedges in perfect content, even though the ground be thickly covered with snow.

The female, though really the more important of the two, is seldom noticed. Her wings are mere rudiments, and she is unable to fly. She only appears at night, when she crawls up the stems of trees for the purpose of depositing her eggs upon them. When the little caterpillars are hatched, they make their way to the unopened buds, and burrow into them, thus

L



1. *Cheimatobia brumata*. 2. *Oporabia dilatata*. 3. *Melanippe hastata*.
4. *Melanippe montana*. 5. *Melanthia albicillata*.

at the same time concealing themselves from sight, and doing all the harm of which so tiny a creature is capable. It is in search of these caterpillars that the small birds, more especially the bullfinch and chaffinch, pick off and devour the buds of fruit-trees. It is true that they do not restrict themselves to those buds which contain caterpillars, but that they act rather at random, picking off a bud first, and afterwards

looking to see whether or not it contains a caterpillar. Still, the good that they do very much counterbalances the harm, and the little birds should be allowed to have their own way with the fruit-trees. The late Mr. Waterton would never allow a single little bird ever to be scared from his trees, much less killed, and I never saw anywhere better prospects of heavy crops.

Various plans have been tried to exterminate these mischievous caterpillars. Being silk-spinners, they lower themselves by their threads when alarmed, and, by taking advantage of this habit, the gardener can kill great numbers of the larvæ by simply tapping the boughs so as to frighten the caterpillars from their food. But 'prevention is better than cure,' and, on account of the structure and habits of the female, she can generally be prevented from depositing her eggs. Had she wings, nothing could be done; but as she is wingless, and is forced to climb up the trunks of trees before she can lay her eggs, it is mostly possible to prevent her from doing so. If the trunks of the trees be kept smeared with a sticky compound, renewed as soon as it begins to harden, vast numbers of the female can be interrupted in their march up the tree, and detained until they are slaughtered by the gardener.

Then, at night, the gardener should examine the trunks of all trees by the aid of a lantern, and he will be sure to find a number of female Winter Moths, each desirous of depositing her stock of two hundred eggs. I should fancy that birdlime might be useful. A mixture of Stockholm tar and cart-grease has been recommended; but if I had any standard fruit-trees, especially plums, greengages, or filberts, I should try the efficacy of bird-lime. In this part of the country, where cherry orchards abound, the fruit-growers paint the trunks of the trees with whitewash mixed with weak size. This process may or may not be efficacious, but there is no doubt that it is very unsightly, making the otherwise beautiful cherry-orchard an absolute eyesore.

When the caterpillar has become too large to be contained within the bud, it turns its attention to the young leaves, fixing its silken threads to their edges, and drawing two or three together, so as to form a sort of tent, in which it lives.

It is not at all particular as to the tree on which it feeds, and, although it certainly prefers fruit-trees, may be found on almost every tree which is grown in England. The caterpillar is full-fed about May, and then descends to the ground, in which it burrows to a very little depth, and there changes to a pupa.

CLOSELY allied to the Winter Moth is the NOVEMBER MOTH (*Oporabia dilatata*), which is shown on Woodcut L. Fig. 2.

It is a prettier insect than the preceding, and exceedingly variable in its markings, so that different names have been given to the most common variations, no less than seven such names having all been referred to this single species. The ground colour of the wings is mostly blackish-grey, and the waved lines which cross them are blackish-brown, the lower wings being paler than the upper pair. This Moth is very common, and may be found in the month from which it takes its popular name. The caterpillar, like that of the Winter Moth, is a general feeder, and can be found on almost any tree. It is full-fed somewhere about midsummer. Its general colour is velvety green with a white stripe behind the spiracles, and it is often marked with purple, especially towards the end of the body.

ON Woodcut L. Fig. 5, is shown the BEAUTIFUL CARPET (*Melanthia albicillata*).

This is a singularly beautiful insect, the colours, though not brilliant, being arranged and contrasted in a most charming manner. The upper wings are cream-white, and on each of them are two rich brown patches, one at the base and another on the costal margin near the tip. The hind margin is dusky, and upon it are drawn two delicate waved grey streaks.

The caterpillar is nearly as pretty as the perfect insect. It is deep velvet-like green, and in the middle of the body is a row of orange-brown spots. It feeds on the bramble, and is full-grown at the end of summer.

NEXT comes that very striking insect called appropriately the ARGENT AND SABLE (*Melanippe hastata*), which is shown on Woodcut L. Fig. 3. As may be inferred from the name,

the colours of this Moth are entirely black and white, mostly arranged as seen in the illustration, though there is some variation in different specimens. Even the body is black and white, and the very antennæ are black, with white rings.

The larva is rather variable, but is generally very dark brown, with a series of small black dots along each side, and another row of crescent-shaped white marks below the spiracles, each of which is surrounded with a white ring. It feeds on several trees and plants, such as the birch, and always lives in concealment, drawing together with silk the leaves of the plant on which it feeds, and living within this shelter. It is full-fed towards the middle of the autumn, and the perfect insect appears at the beginning of the following summer.

ANOTHER species of this beautiful genus is shown on the same Woodcut, Fig. 4. This is the SILVER GROUND CARPET (*Melanippe montana*).

The upper wings of this Moth are cream-white, and across them is drawn an irregular stripe of dark ochre-grey, which mostly has a whitish patch upon it near the costal margin of the wing. There is a small triangular patch of similar colour at the base of the wing. There is a smoky grey edging to the wing, through which is drawn a waved whitish line. These markings look rather too black in the figure. The larva feeds on the common primrose, and is pale brown, covered with a variety of markings, the most conspicuous of which are three large black spots shaped something like the letter V, upon the seventh, eighth, and ninth segments. The caterpillar is full-fed about the end of March or beginning of April. All the Moths represented in this Woodcut belong to the family of the Larentidæ.

ON Woodcut LI. Fig. 1, is shown the ROYAL MANTLE (*Anticlea sinuata*), a name which was given to the little Moth on account of the beauty of its colouring. The markings of this pretty insect are so many and so complicated that they cannot fully be described, but are generally as follows. The ground colour of the upper wings may be considered as creamy grey, and at the base is a large triangular patch, divided by several bars of a lighter colour. Towards the tip of the wing is a

blackish patch, and the rest of the wing is taken up with zig-zagged and scalloped lines drawn as seen in the illustration. There is a great resemblance between the various members of this genus, and one or two, such as the FLAME MOTH (*Anticlea rubidata*) and the SHOULDER STRIPE (*Anticlea badiata*), are so much alike that a sharp eye is required to distinguish the one from the other.

The larva of this Moth feeds on the Lady's Bedstraw (*Galium verum*), and the colour is green with two black stripes along

LI



1



3



2



4



5

1. *Anticlea sinuata*.2. *Scotosia certata*.3. *Cidaria sagittata*.4. *Chesias spartiata*.5. *Tanagra chcerophyllata*.

the back. There are numbers of little black hairs scattered over the whole body. About the middle of autumn it is full-fed, and then spins for itself a web among the leaves of its food-plant. It passes the winter in the pupal state, and appears as a Moth in the summer of the following year.

A VERY pretty insect belonging to this large family is the SCARCE TISSUE (*Scotosia certata*) which is represented on Woodcut LI. Fig. 2.

This is a larger Moth than the others. The hind margin of both pairs of wings is scalloped, that of the upper pair very slightly, and that of the under pair more boldly cut. The specific name of *sinuata*, or waved, is given to the insect in consequence of these scallopings of the wings. The colour of the wings is pale grey brown, and across them are drawn a number of irregular bars, as shown in the illustration. Just inside the hind margin of both pairs of wings runs a narrow black line, following the outline of the scalloping.

The larva feeds on the barberry, and regarding it Mr. Newman makes the following* remarks: 'When young they spin together two leaves of the barberry, adjusting the edges with so much care that the two leaves look like one. The back of the upper leaf I always find applied to the face of the lower, and between these leaves the enclosed caterpillar rests in a curved posture, the head brought round to touch the side of the tenth segment, but the caterpillar always resting on its ventral surface, and not ring-fashion. In this retreat it eats the cuticle and parenchyma of the upper leaf, its operations always betraying its whereabouts by the appearance of a large brown blotch on the surface.'

This caterpillar is blue-brown above, with a black stripe on each side, and a row of orange spots beneath them. It is full-fed about midsummer, and the perfect insect appears at the end of the spring of the succeeding year.

OUR last example of this large family is the MARSH CARPET (*Cidaria sagittata*), one of our most local insects.

The upper wings of this pretty Moth are delicate fawn colour, on which are two bold patches of very dark olive-brown edged with white, one occupying the base and the other the middle of the wing. The latter runs out into a sharp angle towards the hind margin, and assumes a shape which has been fancifully thought to resemble an arrow-head. The specific name of *sagittaria* has been given to the insect in consequence of this supposed resemblance. The lower wings are comparatively pale and without much marking.

The larva feeds upon the meadow-rue (*Thalictrum flavum*), a plant which grows only in places which are constantly wet, such as the ditches of water-meadows and fen districts. For this reason the Moth has received its popular name of Marsh Carpet. The fen district of Cambridge is the only locality in which this Moth has been known to occur in England.

The caterpillar feeds mostly on the seeds of the meadow-rue, but will at a pinch eat the leaves or panicles of other plants belonging to the same genus. It is a singularly pretty caterpillar and very curiously shaped. Each of the segments, from the fifth to the tenth inclusive, is developed above into a sort of hump, and at the side into a lobe or flap, which contains the spiracle. The top of each hump is deep velvety olive-green, and the spaces between them are in some specimens bright leaf-green, and in others rose-coloured, a velvet-black edge throwing out these colours in a most beautiful manner.

This lovely caterpillar finishes its feeding towards the middle of autumn, and generally spins a web among the flowers of the food-plant, in which it undergoes its changes. Sometimes, however, it descends to the ground, and there takes the pupal form. The perfect insect appears in summer, but can only be found by those who know where to look for it, as it has hitherto been only found in one county of England.

There are many of the Moths which are popularly termed 'Carpets.' This name is given to them because the beautiful patterns of their wings are thought to have some resemblance to those of carpets. I only wish that the patterns of carpets resembled those of the wings.

THE family of the Eubolidæ is represented in this work by the Moth which is appropriately termed the STREAK (*Chesias spartiata*), and is drawn on Woodcut LI. Fig. 4.

The insect is easily recognised by the peculiarity from which it derives its name, viz. the white streak which runs nearly from base to tip of the light brown wings. There is a slight white line that runs just inside the hind margin, and three rather indistinct darker oval marks, one above the streak and the other two below it. A sort of silky or satiny sheen glosses the surface of the upper wings. The lower wings are much paler than the upper, and the whole body is dark greyish

brown with a silky gloss. The larva feeds on the common Broom (*Spartium scoparia*) whence its specific title of *spar-tiata*. The Moth appears in September.

THE last of the Geometræ scarcely looks as if it belonged to that group. This is the common CHIMNEY-SWEEPER (*Tanagra chærophyllata*), which is represented on Woodcut LI. Fig. 5.

As may be inferred from its popular name, the colour of this Moth is sooty-black. The fringe is grey, except at the tip of the upper wings, where it is snowy-white. The larva is rather a pretty one, being dark green with a few lines of olive-green and light green. The spiracles are red. It feeds on the common earth-nut, or pig-nut (*Bunium flexuosum*) and is full-fed at the beginning of June, when it descends into the earth and changes to the pupal state. At the end of that month it assumes its perfect form, and in many localities appears in great numbers.

CHAPTER IV

PSEUDO-BOMBYCES, DREPANULÆ, AND NOCTUÆ.

THE two first of these groups are gathered by Mr. Newman into one group, which are termed Cuspidates, because the tail of the larva mostly ends in a cusp or point. Some of the strangest caterpillars in the world belong to this group, and we have in sober England a number of Cuspidate larvæ which may rival the most wonderful productions of the tropics for beauty of colour and strangeness of form, the latter being in many cases actually grotesque.

The Pseudo-Bombyces are so called because the Moths look at first sight as if they belonged to the true Bombyces. The structure and habits of the caterpillar, however, show that these Moths are very rightly placed in a separate group.

The first family is the Diceranuridæ, so called on account of the structure of the larva. The name is formed from two Greek words, signifying Double-tailed, and is given to these insects because the tail of the larva is very deeply cleft, so as, in fact, to resemble two distinct tails.

The first of these insects is the common PUSS MOTH (*Dicranura vinula*), which is represented on Plate XV. Fig. 4.

This insect affords another example of the effect which can be got out of simple black and white. The upper wings are soft greyish-white and rounded at the tips, and have a peculiar softness in their general aspect. Most of the larger nervures are without scales, and show themselves conspicuously, but at the branches they are thickly covered with black scales. The wings are covered with bold markings in black and dark grey, as seen in the illustration. The lower wings are white at the base, deepening to blackish grey towards the margin, and have a few dark spots on the fringe. The large thorax is covered with long, soft down of a snowy-white colour, diversified with

eight very black spots, so that it strongly reminds the observer of minever. The head is also white, and is held so much under the thorax that, when the creature is at rest, the head is quite invisible, and nothing can be seen but the ends of the antennæ, which are laid along either side of the thorax.

The caterpillar of this pretty Moth affords a singular example of grotesque form and beautiful colouring. The head is flat, and, when the creature is at rest, is drawn back into the second segment. The fourth segment is produced into a large and pointed hump, and from the ninth segment the body tapers to the end. Here are developed two rough horn-like projections, from each of which can be protruded a horny pink filament, which seems to be employed as a weapon. It has been suggested that these appendages are used for the purpose of driving away ichneumon-flies when they settle on the body in the hope of depositing their eggs. Whether this theory be correct or not is undetermined, but the caterpillar certainly does protrude them when irritated. The larva has another weapon, if it may be so called. Below the head there is a transverse slit about the sixth of an inch in length. When the creature is alarmed or angered, from this aperture is ejected a fluid of an acrid character, which may probably have some injurious or deterrent effect upon the enemies of the Puss Moth larva.

The colour of this caterpillar is singularly beautiful—leaf-green on the sides and whitish above, with some stripes of purple-brown. Between these two colours a white stripe runs from the side of the head to the tip of the hump, and then passes to the base of the double tail. The stripes are so arranged that when the larva is viewed from above, they appear something like the capital letter X. In some specimens, though not in all, there is a large purple patch on the eighth segment.

This larva feeds both on the willow and poplar, and, being very hardy, is easily reared throughout its changes. When full-fed, which takes place about the end of May, it leaves its food, crawls down the trunk of the tree, and creeps into some convenient crevice of the bark. In this refuge it forms a cocoon made of small chips of the bark fastened together with silk, and of wonderful strength. The cocoon, indeed, is mostly

constructed of silk, the bark chips being merely added to it in order to make it agree in appearance with the trunk of the tree. Moisture does not soften this silken secretion, though air hardens it, and the consequence is that after exposure to the atmosphere, the cocoon becomes as hard as if made of horn, so that the inmate is safe from nearly all enemies ; while the exact similitude between the surface of the cocoon and the bark of the tree renders it almost incapable of discovery.

A very good specimen of this cocoon in my collection was discovered by me quite accidentally, and so precisely did it resemble the bark of the tree that I was obliged to keep my finger on the spot while I opened my knife, fearing that if I once lost the exact place I should never find it again. If the larva be kept in captivity, and deprived of material from which the wood-chips of the cocoon are formed, it is obliged to form its habitation entirely of silk, and thus enables the observer to see the construction of this remarkable cocoon. Though formed of silk, it is not made like that of the silkworm Moth, of a thread which is wound into an oval shape. No thread is visible, but the whole cocoon looks (and feels) as if it were made from very thin horn, so translucent that the form of the inmate can easily be seen through it. I imagine that, although the cocoon is spun like that of the silkworm and other Moths, the silk does not harden immediately it comes in contact with the atmosphere, so that the whole mass becomes fused together, and the individuality of the thread is thereby lost. I have reared many of these larvæ, and found that, although they would always use portions of their food-plant in the construction of the cocoon, they were really quite independent of it, and did not suffer in any way by being obliged to form their dwelling entirely of silk.

It is always easy to force a Puss Moth larva to form such a cocoon. When it is full-fed it loses the brilliancy of its colours, a brownish hue comes over its body, and it looks as if it were about to die. It should then be removed from its food-plant, and placed in the glass vessel in which the cocoon is to be preserved for the collection. After the cocoon is fully formed, the vessel should be subjected to the vapour of bruised laurel leaves long enough to kill the pupa, and the dead insect

should then be carefully dried in an oven, and the case rendered air-tight.

The caterpillar is full-fed about midsummer, and, passing the winter in its chrysalis state, is developed into the Moth in the following June.

1. *Cerura furcula*.2. *Stauropus fagi*.3. *Notodonta dromedarius*.a. *Stauropus*, larva.b. *Notodonta*, larva.

NEXT in order comes the Moth which, as the larva feeds on sallow and the insect belongs to the same genus as the Puss Moth, but is much smaller, is popularly termed the SALLOW KITTEN MOTH (*Dicranura* or *Cerura furcula*). This insect is represented on Woodcut LII. Fig. 1. The specific name of *furcula* signifies a little fork, and is given to the insect in consequence of the shape of the larva, which is terminated by two diverging horns, continuous in their outline with that of the body, and not projecting from it like the horn of a Hawk Moth larva.

Though not so strikingly handsome an insect as its larger relative, the Sallow Kitten is really a pretty Moth. The upper wings are greyish white, traversed by a number of black-grey streaks arranged as seen in the illustration, one or two of them being accompanied by a line of yellow. The lower wings of the male are pure white, clouded with grey and having a few blackish spots, while those of the female are mostly dusky. The thorax is coloured like the upper wings, and is crossed transversely by three bars of black and yellow.

The larva is shaped and coloured very much like that of the Puss Moth, but may be recognised by the shape of the body with its deeply forked end. When the larva is full-fed, it spins a cocoon much like that of the Puss Moth, and the perfect insect appears in June.

ON Woodcut LII. Fig. 2, is drawn a Moth which in the perfect state does not attract much attention, but which, as a larva, is one of the most extraordinary beings that England possesses. In fact, supposing that the creature were not known, no artist would dare to figure so bizarre an object; for if he did so, all the entomologists would be in arms against him, and say that such a creature could not possibly exist.

The shape and markings of the insect can be seen by reference to the illustration, and as the wings are merely grey-brown marked with a darker tint, they need not be described in detail. The figure represents a male. The female is similarly coloured, but is larger, and her antennæ are thread-like and without the feathering.

Now we come to the larva, which is shown at Fig. *a* of the same illustration. The three remarkable characteristics of this larva are the enormously long legs, so unlike the short, feeble legs of most caterpillars; the high and pointed humps of the middle segments, and the enormously developed thirteenth, or last segment, with its double, club-shaped horns.

The attitude in which it is represented is that which it assumes when at rest. The colour is reddish-brown, profusely spotted with minute dots of a paler hue, and there are two slight blackish stripes along the back, and a grey stripe between them. There are also a few black marks on the sides of the body. This extraordinary caterpillar feeds on oak and

beech, and, when it is full-fed, which occurs about the end of September, it spins together several leaves, and within them makes its cocoon. At the beginning of winter the leaves fall, but the habitation which the caterpillar has made is so formed that it protects the inmate from the shock of the fall, which, however is but slight, as the dry, withered leaves and enclosed cocoon are very light, and only come fluttering gently to the ground. The perfect insect appears in June. It is not a common Moth, and is never found in the northern parts of England.

The scientific name of this insect is *Stauropus fagi*, and its popular title, the LOBSTER MOTH. Both names refer to the caterpillars. The word *Stauropus*, or stake-footed, refers to the great length of the legs, which almost look as if they were slender sticks projecting from the larva; and the name of Lobster Moth is given to it because the larva is thought to resemble a lobster rather than an ordinary caterpillar, the uplifted and enlarged last segment doing duty for the claw.

THE very common and really handsome Moth, the BUFF-TIP (*Pygæra bucephala*) is drawn on Woodcut XLVII. Fig. 1, page 439. The figure represents a male with its wings spread.

The upper wings of this Moth are beautifully coloured with various shades of grey, crossed with bars and bands of different browns, mixed here and there with ochreous yellow, and taking a slight purplish gloss along the costal margin. At the tip of each wing is a large buff blotch, marked off from the rest of the wing by two dark-brown lines enclosing a grey line between them. The buff blotch has on it a few markings of deeper hue. The hind wings are paler greyish ochre, and the whole of the under surface is of the same colour, with the exception of a dark bar crossing the lower wings diagonally, and a dark hind margin to the upper wings. The thorax is large, covered with dense, gold-coloured down, and nearly conceals the head.

When at rest, this Moth presents a very curious aspect. The wings are pressed against the body which they cover, the two yellow spots at their tips exactly balancing at one end the yellow thorax at the other. The large thorax itself looks very much like a head, and on that account the specific name of *bucephala*, or ‘bull-headed,’ has been given to the insect. In

consequence of the peculiar aspect of the quiescent attitude, the Buff-tip Moth often escapes observation, as most persons would mistake it for a piece of dried stick.

The caterpillar feeds upon the lime, the elm, the hazel, and one or two other trees, and often does considerable damage. It is semi-social in its habits, and, though plentiful, is not often seen until full-fed, in consequence of its peculiar idiosyncrasies. The eggs are laid in batches, sometimes as many as sixty in number, on the upper part of a leaf, and when hatched, the little caterpillars belonging to each brood remain together, and feed on the upper surface of the leaf. After their first change of skin, they break up into six or seven small companies, and each company remains together until the change into the pupal state is at hand. As they become larger they make their way to the topmost branches, where they work great havoc among the leaves, often leaving bough after bough completely denuded of foliage.

When full-fed they separate, and each caterpillar makes its way down the tree, and starts off on its travels in search of a resting-place in which it can pass its pupal state of existence. Being very numerous and very conspicuous, these caterpillars are familiar to most residents in the country. They go resolutely in their search, making their way over everything in their path, utterly careless of observation. In some places they are so numerous that they become a positive nuisance, and, indeed, I do not know any creature which has a greater talent for getting in the way.

Towards the beginning of August these caterpillars begin to show themselves, and anyone who wishes to rear the Moth from the caterpillar may procure as many as he likes. Last year (1870) they grievously offended tidy housekeepers by their intrusion. It was hardly possible to set foot outside the door without crushing one or two of them on the white door-step, and, not content with infesting the steps and paths, they crawled into the houses, and travelled over carpets and oil-cloths as determinately as if they had been traversing the fields. When at last they have suited themselves with a spot which seems to them a favourable one, they throw off the last caterpillar skin, and change into smooth brown pupæ. These pupæ are wonderfully hardy, enduring the frost of winter

without the least protection, and emerging in the perfect state in the early summer of the following year. Pupæ so exposed are naturally liable to destruction. Uncounted thousands are eaten by birds, and, indeed, were it not for the destruction that awaits the larger proportion of the larvæ as they travel in search of resting-places, and the havoc that is made among them in the pupal state, their armies would be so enormous that scarcely a forest tree would survive their ravages.

The colour of the caterpillar is yellow, covered with a number of short longitudinal black bars arranged in nine rows, as seen at Woodcut XLVII. Fig. *a*. The pupa is remarkable for the doubly forked apparatus at the end of the tail.

NEXT comes a family of Moths called Notodontidæ, or Tooth-backs, because the backs or inner margins of the upper wings are toothed, or have elevated portions along the inner margins, from which they derive the popular name of Prominents. As an example of these Moths we will take the IRON PROMINENT (*Notodonta dromedarius*), the male of which is shown on Woodcut LII. Fig. 3.

The colouring of this insect is very simple. The ground hue is brown, with a slight purplish tinge, upon which is a broad rust-red streak and two small pale bars, arranged as seen in the illustration. The outlines of all the markings are vague and indistinct, and there is considerable variation in different individuals. The lower wings are greyish brown, with a dark spot on the disc, and two pale and ill-defined bars.

The caterpillar, although not so bizarre in appearance as that of the Lobster Moth, is yet a very quaint and odd-looking creature. A portrait of this larva is given at Fig. *b* on the same Woodcut. As may be seen by reference to the figure, the head is comparatively large, and the second and third segments are so small as to form a sort of neck. From the fifth to the ninth segments the back is humped. The colour is rather pretty, being green more or less tinged with yellow, and marked with a very deep purple-brown. There are other markings, but the shape of the larva is so peculiar that minute detail is not needed for its identification.

This caterpillar may be found on the birch, where it remains until full-fed, an event which takes place somewhere about the

end of September. It then descends the tree, and beneath it spins for itself a slight cocoon, which is generally screened from observation by having a fallen leaf fastened to its upper surface. In this exposed situation it changes into a pupa, and there lies until the following June, when it assumes the perfect form. The insect is, and yet is not, a common one. Those entomologists who have not yet learned to look behind the scenes of Nature's theatre reckon the Iron Prominent to be quite a rarity; while those who have been long accustomed to the practical study of insects and their ways, experience no great difficulty in obtaining either the moth, the pupa, or the caterpillar, and in consequence consider the Iron Prominent as rather a plentiful insect.

WE now come to one of the largest groups of British Moths, the NOCTUÆ, so called because, as a rule, they are exclusively night-fliers, and never, except by accident, appear in the day-time. In these Moths the body is almost always stout and thick, as is the thorax, the hairs of which often rise nearly erect, so as to form a sort of crest. Generally these Moths hide themselves by day, taking advantage of crevices in walls, the bark of trees, old posts, palings, and invariably selecting those which best harmonise with the colour of their closed wings. So close is often the resemblance between the colour of the insect and that of the object on which it rests, that even the most experienced and keenest entomologists often find themselves deceived, and have only detected the well-disguised insect when, by an accidental touch, they have forced it to take flight. Even those species which have their under wings adorned with beautiful colours, have almost invariably their upper wings plainly mottled with brown, grey, black, and dun, so that when they are at rest the splendid under wings are concealed, and their glories veiled by the sombrely tinted upper pair. Many, in fact, most of them, have both pairs of wings coloured in the simplest and least imposing manner, not even having any bold black, white, or brown markings on either pair of wings. Consequently, when a number of Noctuæ, which are of about the same size, are collected, it is a very difficult matter to refer them to their proper positions, and

even the most skilful of entomologists is forced to refer to his books before he can, with any confidence, assign to some sixty or a hundred Noctuæ their exact names.

As they mostly fly by night, and are always attracted by light, these Moths form the greater number of those which are captured by the familiar and most efficacious process of 'sugaring.' This process may be briefly explained. The intending sugarer mixes together the roughest and coarsest of sugar—'foots' as it is called—with water or beer, and boils them together. I believe that water is quite as efficacious as beer. He may then cork it up tightly in bottles, and keep it until he wants to use it.

On some dark, calm evening—the latter attribute being absolutely necessary—the entomologist pours a sufficiency of the mixture into a basin, adds a few spoonfuls of new rum, and steeps in it ten to sixteen pieces of old rag. When the rags are thoroughly soaked, he removes them, allows the superfluous moisture to drip from them, puts the saturated rags into a tightly closed vessel, and pours the rest of the sweet liquid into the bottle, in readiness for the next occasion.

Provided with a number of pill-boxes, the ordinary net, pins, forceps, and other entomological paraphernalia, the collector further adds a dark lantern—not a 'bull's-eye'—a box of matches, and a small bottle of chloroform, or, in default thereof, a 'laurel-bottle,' in which the pounded laurel leaves are made up into little packets about as wide as a sixpence and as thick as a penny. Arrived at a spot where there are plenty of trees, the collector lights his lantern, takes the saturated rags from the box, and pins them upon the trunks of trees, taking care to arrange them as nearly as possible in a circle, so as to concentrate the odour of the sugar and rum. When he has pinned up the last piece of rag, he sees that his apparatus is all in good order, and slowly goes round his former track, always taking care to throw the light of the lantern on the rags.

Should the night be favourable, an extraordinary sight presents itself. Hundreds of Moths are converging upon the spot from all directions, and as many others are gathered round the sweet mixture, while every now and then the two round eyes of some large Moth glow amid the darkness like two balls of fire. Some of the commoner kinds are often in

such profusion as to be absolutely annoying, crowding to the sugar in multitudes, and quite distracting the eye of the collector from the Moths which he wishes to take. With a little practice, however, the task of selection becomes a tolerably easy one, and there are few nights when valuable additions may not be made to the cabinet. When the collector has made the round of his sugar rags often enough, he unpins them, and puts them back into the tin box ready to serve for another occasion. This plan is far less cumbrous than the old method of carrying a jar of sugar and beer and a brush wherewith to spread the compound on the trees.

Most of the pupæ of the Noctuas undergo their changes beneath the surface of the ground, and the chrysalids that are found by the collector when 'digging for pupæ' generally belong to this group of insects.

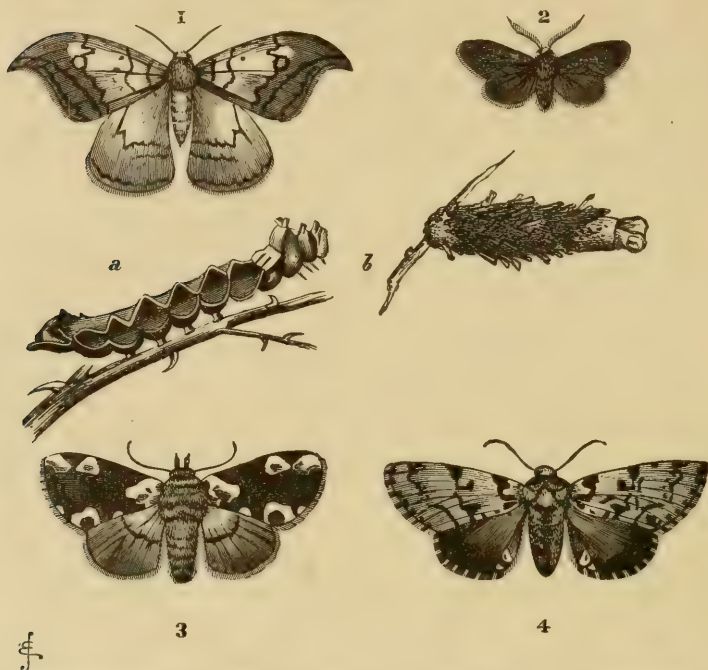
OUR first example of the Noctuas is the pretty PEACH-BLOSSOM MOTH (*Thyatira batis*), which is represented on Woodcut LIII. Fig. 3.

This very pretty Moth has received its popular name in consequence of the colouring of the wings. The upper pair are olive-brown, decorated with four large and conspicuous spots, the largest being at the base of the wing, and one smaller spot on the inner margin. These spots are lovely pink in the middle, surrounded with white, and each of them really does bear some resemblance to the petal of a peach-blossom. A few bars of rose-colour cross the brown thorax. The body is brown, and has a small crest on the back of the second, third, and fourth segments. The beautiful pink colour of the spots is very liable to fade, unless the insect be very carefully kept in the dark. Several of my specimens have almost lost their lovely pink in consequence of being kept in a badly constructed cabinet. The Moth is tolerably common.

The larva of this insect is a very odd-looking creature, as may be seen by reference to Fig. *a* on the same Woodcut. Its colour is warm chestnut-brown mottled with grey, and the surface has a velvety aspect. One peculiarity in this caterpillar is that it seems to make no use either of its true legs or of the claspers at the end of its body, but clings to its food plant by means of the claspers of the middle of the body.

The largest hump is that of the third segment, and it is furnished at the top with a cleft projection. This curious larva can be found on the common bramble, and is in best condition about the end of August, or beginning of September, when it is full-fed, and about to 'spin up.' When it finally ceases to feed it spins a slight cocoon, which it fastens among the leaves, changes into the pupal state, and makes its appear-

LIII

1. *Platepteryx falcula*.2. *Psyche opacella*.
a. *Thyatira*, larva.3. *Thyatira batis*.
b. *Psyche*, larva.4. *Diphthera Orion*.

ance as a Moth in the ensuing summer. This pretty Moth used to be very plentiful about Oxford when I was collecting there. It belongs to the family Trifidæ.

NEXT comes an example of the Bombycoidæ—a Moth quite as beautiful as the preceding insect, but with a different style of beauty. Its scientific name is *Diphthera Orion*, and its popular title the SCARCE MERVEIL DU JOUR. See Woodcut LIII. Fig. 4.

The colour of the upper wings is very remarkable. The

ground hue is bright green, across which four pure white stripes are drawn longitudinally, and three black jagged bars transversely. The two middle white stripes are the widest, the two others being quite narrow, one running close to the costal margin of the wing, and the other equally close to the hind margin. The hind margin is edged with a row of spots having the centre white and the exterior black. The head is green, like the upper wings, and the thorax is green in the middle, black in front, and black and pale green behind. The lower wings are smoky-grey, and with a dark spot on the disc, and a few white lines at the anal angle.

The caterpillar is a very pretty larva, blue-black on the back, and adorned with orange and pale yellow on the sides. It has been known to feed both on birch and oak, and Mr. Crewe, who reared some of these insects from the egg, thinks that the caterpillar feeds alternately on oak and birch, passing from one to the other at will. I scarcely see how this can be the case, as oak and birch trees are not always in proximity to each other, and, unless their branches actually touched, it is difficult to see how the larva could pass from one tree to another. The pupa forms for itself a cocoon of gnawed wood, and the perfect insect appears in June. It is a rare species, but has been found in Kent, the New Forest, near Ipswich, and one or two other localities.

THE Moth which is represented on Woodcut LIV. Fig. 1, is an instance of an insect, which was once plentiful, becoming rare. Its popular name is the DOUBLE-LINE, and its scientific title is *Leucania turca*. It is an example of the group *Genuinæ*, and the family *Leucanidæ*.

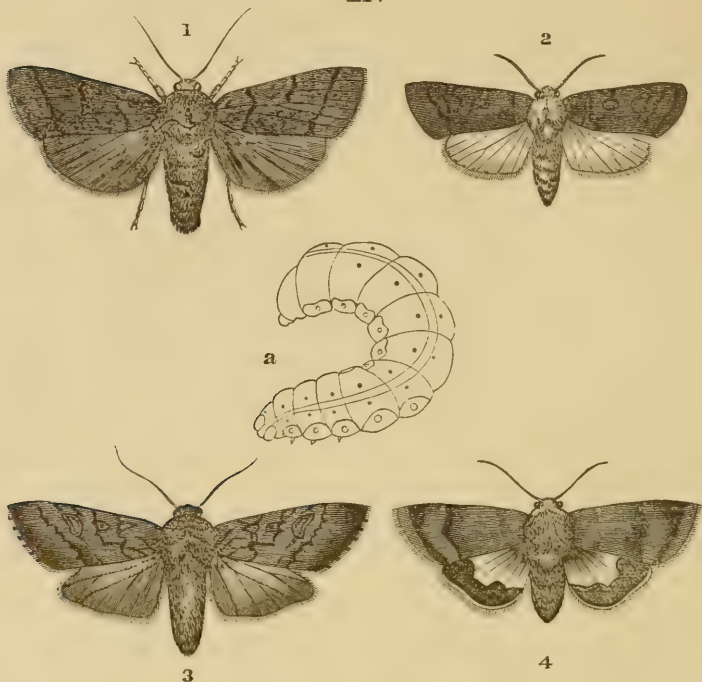
The colour of this Moth is simple. The ground hue of the upper wings is brick-red, very much like that of red blotting-paper, but rather duller and browner, and across them are drawn two dark brown bars, which have gained for the insect its popular name. In the middle of the wing is a small, curved, white spot. The lower wings are pale brown, becoming reddish on the margins.

The larva feeds on wood grasses, and is mostly to be found in the southern parts of England, especially those which are near the coast. The Moth appears in June.

ON the same Woodcut, at Fig. 3, is shown the too common CABBAGE MOTH (*Mamestra brassicæ*).

That this Moth subserves some good purpose is evident from the fact of its existence, but what that purpose may be is not easy to discover. It may, perhaps, be useful in keeping down the too abundant vegetation in wild and uncultivated countries, and so may have done good service when this land was one vast

LIV



1. *Leucania turca*. 2. *Agrotis segetum*. 3. *Mamestra brassicæ*. 4. *Tryphæna janthina*.
a. *Tryphæna*, larva.

hunting-ground, and our predecessors used flint instead of steel, and a wash of woad by way of dress. At all events, it is very much out of place so far as regards civilised society, and we could well spare it if it had been improved off the face of creation, in company with the wolf, the bear, and the beaver.

The caterpillar of this Moth is one of the most voracious herb-feeders in this country. It can eat almost any herb, but prefers those which belong to the cabbage tribe. As for those

which are cultivated with solid masses of vegetation, such as the summer-cabbage and the broccoli, this larva is terribly destructive, burrowing through and through the very heart of the vegetable, and leaving behind it a track or gallery, filled with the watery juices of the plant and the ejecta of the caterpillars. For my part, I have seen so much of these abominable beings that I have not for many years ventured to touch a 'summer-cabbage.' I am not particularly fastidious, but have not yet brought myself to appreciate boiled caterpillars, and rather fancy that I never shall accept them as an article of food.

It is quite impossible for the cook to extirpate them from the cabbage, no matter how conscientiously she may steep it in strong salt and water. Those caterpillars which are merely lurking between the leaves are dislodged easily enough, and often come tumbling out in such numbers that the cook is persuaded that she has completely ejected them. But, deep within the heart of the cabbage, sorely grieved indeed by the salt, but too deeply buried to make their escape, are sundry of the largest and best-fed caterpillars, which are eventually boiled with the cabbage, and mostly eaten ignorantly by those who partake of the vegetable. During life they are darker than the bright green of the leaf, but the boiling water reduces leaf and caterpillar to a very similar hue, and it is not easy to distinguish the one from the other.

The colour of the upper wings of this Moth is dark greyish-brown, mottled variously with darker brown and grey. The lower wings are paler brown, with a smoky or blackish tint. The caterpillar is exceedingly variable in its colours, but is generally olive-brown above and yellow below, and on the back of each segment is a blackish triangular mark in which are two white dots. Sometimes the body is pale dusky-green above and below. When full-fed it descends to the earth, makes a shallow burrow in it, and changes to a smooth brown chrysalis. Both the Moth and caterpillar are plentiful through the summer, and during the autumn the ground may be nearly cleared of pupæ by judicious digging and hand-picking.

THE family of the Noctuidæ will be represented by three examples, the first of which is the TURNIP MOTH (*Agrotis segetum*), which is drawn on Woodcut LIV. Fig. 2.

This is a small and inconspicuous Moth, but it does far more damage than many Moths of much larger size and more conspicuous colouring. The larva of this insect is to turnips what that of the last-mentioned insect is to the cabbage, and with this difference, that whereas the Cabbage caterpillar works above ground and may be detected by the eye, the Turnip caterpillar works for the most part below the surface of the earth, and the only evidence of its presence is the drooping state of the plant. When very young, it feeds upon the leaves of the turnip and many other plants, such, for example, as the carrot, or some flower, and in that stage may be removed by hand-picking; but, when it grows larger, it descends towards the earth, fixes upon the upper portion of the root, just where it joins the stem, and there gnaws a groove completely round the stem, the entire plant often dying from the injury. It grows with great rapidity, and, when about three-quarters grown, burrows into the earth and attacks the root itself, beginning near the bottom, burrowing deeply into it, and gnawing large hollows in it.

These caterpillars are only too familiar to agriculturists. They are nearly smooth, grey-striped more or less, and covered with little shining, round spots, from each of which proceeds a short bristle. As a rule, the gardener cannot mistake in killing every brown-looking caterpillar that he finds beneath the ground, for it is sure to be one of those beings that make havoc among the crops, and the greater because their ravages are carried on out of sight. It is principally in search of these destructive caterpillars that the rooks frequent turnip-fields. When the birds are seen busily digging with their powerful beaks, they are engaged in the search after the turnip caterpillar, and not trying to eat the turnip itself.

The whole history of this Moth is a very interesting one, but our space is diminishing so rapidly that we must pass on to other insects.

THE pretty insect which is shown on Woodcut LIV. Fig. 4, is popularly called the LESSER BROAD BORDER (*Tryphena janthina*). It forms one of a group called the Yellow Underwings, because the ground hue of their lower wings is bright

ochreous yellow. The upper wings of this Moth are shining brown, with a slight purplish gloss when viewed in a side light. The purple shows best by placing the insect with the tip of the wing towards the light, and then looking at it from base to tip. On the wing are drawn a number of waved and indistinct bands of chestnut, and there is a decided patch of that colour on the costal margin, near the tip. The under wings are bright orange above, with a brown patch at the base, and a broad, waved black band nearly parallel with the hind margin. This black band is more perceptible on the under surface of the wing.

The caterpillar feeds on several garden-flowers, and, like many of its kin, hides itself by day, and only comes from its place of concealment at night. It has a particular fancy for the crown or top of the root, but will also eat the leaves. It is dull, greyish-yellow in colour, with some pale streaks on the side and eight bold black spots on the back. An outline of this larva is given at Fig. *a*. It is full-fed at the end of spring, when it burrows into the ground, and there changes into a brown, smooth chrysalis, merging into the Moth state towards the end of summer.

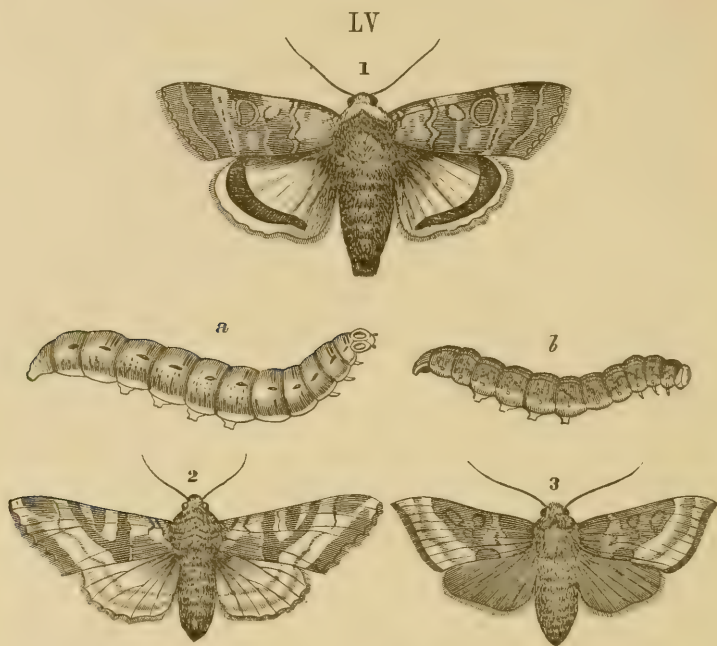
This is a wonderfully pretty little creature, the mottlings of the upper wings being peculiarly rich, and forming an admirable foil to the bold black and orange of the under wings. It is moderately common throughout the greater part of England. My own specimens were taken in Oxfordshire, Wiltshire, and Kent.

THE LARGER YELLOW UNDERWING (*Tryphaena pronuba*), which is figured on Woodcut LV. Fig. 1, is, as its name implies, considerably larger than the preceding insect.

Its upper wings are exceedingly variable in colouring, but are always of some shade of brown. There are several pale, narrow, waving bands drawn across the wing, and on the upper part of the disc a large kidney-shaped black spot with a pale centre and a chestnut outline; there is also a small black spot near the tip. The under wings are orange-yellow, but not so richly coloured as in the preceding insect, and parallel with their hind margin is a bold black stripe, broad above and narrowing below to a point. There is a very slight

golden streak on its costal margin. Beneath, it is remarkable for a shining golden stripe that runs along the lower edge of the upper pair of wings, the gold changing in some lights to prismatic effects of green and blue.

The caterpillar is another of the nocturnal larvæ. It feeds upon the crown, stem, and heart of various garden plants, especially favouring lettuces when they are tied up to blanch. The colour of the larva is as variable as that of the perfect



1. *Tryphaena pronuba*. 2. *Phlogophora meticulosa*. 3. *Plusia chrysis*.
 a. *Tryphaena*, larva. b. *Phlogophora*, larva.

insect, but is generally some shade between olive green and brown, and on the body are a variety of brown and black streaks, as may be seen by its portrait at Fig. *a*. It is a very general feeder, and there are very few garden plants or vegetables which escape its jaws. When full-fed, it forms a kind of rude oval cell, and therein undergoes its transformation into the Moth. Both the caterpillar and Moth are exceedingly common, and may be captured in any numbers.

ON Plate XVI. Fig. 3, is seen the Moth which goes by the popular name of the PINK-BARRED YELLOW (*Xanthia silago*). This insect belongs to the large family of the Orthosidæ.

This is of a brighter hue than the last-mentioned insect, the ground colour of the upper wings being yellow. It is for this reason that the generic name of *Xanthia*, or Yellow, is given to this and other Moths of the same genus. The markings on the wings are purplish brown, and the hind wings are pale brown, taking a yellowish hue towards the hind margin. There is a good deal of colour about the body, the head and the front of the thorax being dark rust-red with a purple gloss, the rest of the thorax yellow, and the body grey with a yellowish tinge.

The larva of this pretty Moth feeds on the sallow, and the perfect insect appears in the middle of autumn. It seems to be widely spread, though not very plentiful.

PASSING over a considerable number of species, we come to an example of the Hadenidæ, the familiar ANGLE-SHADES (*Phlogophora meticulosa*), which is shown on Woodcut LV. Fig. 2.

I have always felt a great predilection for this insect, because it is one of the first Moths that I ever reared. I had found a number of pupæ in the summer, and put them into a small box, which I covered with stout wire gauze, having in those days some hazy idea that a Moth could get through muslin or linen. I had also made up my mind that no Moths could emerge until the following year; and my astonishment was extreme on finding one morning a fine Angle-Shades Moth clinging to the wire gauze, and shaking out its newly-developed wings. Insignificant as is such an incident in itself, it often forms a stand-point in life; and such was the case with this Moth, the development of which under my own eye inspired an interest in this branch of natural history that has never been and never will be forgotten.

The name of Angle-shades is given to this Moth on account of the manner in which the wings are coloured. The upper wings are pale grey, tinged either with ochreous yellow or olive green. In the middle is a bold marking, shaped much like the letter V, and formed of several shades of brown. The

other marks of the wing are also of brown, but not quite so dark. The edges of the hind margins of the upper wings are deeply scalloped. The lower wings are slightly scalloped, and are of a pale yellowish grey and crossed by two very slight waved bands of reddish brown. Towards the hind margins they are suffused with a slight pinkish tint. The thorax is covered with long hair, which in front stands out like the double ruff of Elizabeth's time. Then comes a wedge-shaped ridge in the middle of the thorax, and then two rather large tufts at the back. The colour of these tufts is soft umber brown, tipped with a darker and warmer brown.

The caterpillar of the Angle-shades is represented at Fig. *b* of the same Woodcut. Its colour varies from bright green to dark olive green or olive brown, profusely sprinkled with whitish dots not very well defined. There are three greyish lines along the body, and the spiracles are white, surrounded with a black line. It feeds on various herbs and flowers, especially groundsel and primrose, and is full-fed about May, when it seeks the ground, and there spins a very slight cocoon. There are two broods of this pretty Moth—one towards the end of May, and the other at the end of autumn.

The specific name *meticulosa* signifies fearful or timorous, but I never could find out the reason for giving such a name to the insect. The Angle-shades is not a whit more timorous than Moths in general, and though it has no distinctive boldness, it certainly has no distinctive timidity.

ON Woodcut LV. Fig. 3, is represented the Moth which is appropriately called the BURNISHED BRASS (*Plusia chrysitis*), in consequence of the metallic colouring of the wings. The specific name of *chrysitis*, or gilded, is given to it for the same reason. This insect belongs to another family of the Noctuæ, namely, the Quadrifidæ or Plusidæ.

The colour of the upper wings is bright golden green, which must be seen in a side light before its beauty can be properly distinguished. There is a large and nearly triangular blotch of brown on the middle of the wing, the base of the triangle resting on the costal margin, another patch of the same colour at the base, and a third on the inner margin, just below the large triangular patch. These two often coalesce, as is the

case with the specimen now before me. The hind wings are greyish brown, and so is the body.

The caterpillar is green, with a row of white dots under the spiracles, a white streak above them, and six white marks on the back of each segment. It assumes a curious attitude when at rest, the front of the body being bent upwards, so that the caterpillar only holds to its food-plant by its claspers. There are two broods of the Burnished Brass Moth in the year—one in the early summer, and the other in the middle of autumn. It feeds on several plants, such as the common white dead-nettle, and even the stinging-nettle.

The Moth, when preserved, is very liable to 'grease,' which will sometimes affect it to such a degree that a whole row of Moths will be deprived of their beautiful metallic lustre, the wings becoming almost uniformly brown, with a sort of rusty red hue, in the place of the gold-green which formerly adorned them. In such a case, the only plan is to saturate the insect with benzole, by dropping it on the thorax, and, when it is completely steeped, even to the tips of the wings, in that useful but mal-odorous liquid, to let it dry in a strong draught. The most effective mode of doing this is to open a window about an inch and a half, pin the insect under the window, and then leave the door open. In the winter time, the fire will cause sufficient draught. The Moth should be fixed with its head pointing to the interior of the room, so that the in-rushing air may blow up the downy plumage of the body and prevent it from being plastered down, as often is the case if this precaution be not taken.

To the same pretty genus belong several other well-known Moths, such as the SILVER Y (*Plusia gamma*), so easily recognised by the bright silver mark in the middle of the upper wings, closely resembling the English letter Y or the Greek letter gamma (γ). Then there is the BEAUTIFUL GOLDEN Y (*Plusia pulchrina*), the upper wings of which have a Y-like mark of burnished golden scales, and below it a round spot of the same colour. Another of these Moths is the GOLD SPANGLE (*Plusia bractea*), in which the upper wings have on the disc a moderately large and nearly square spot, which looks as if a patch of gold-leaf had been placed on the wing, and brilliantly burnished.

If the reader will refer to Woodcut XLVIII. on page 449, and Fig. 1, he will see a portrait of the well-known HERALD Moth (*Gonopteryx libatrix*), our only British representative of the family Gonopteridæ.

Even were not the colour of this insect so conspicuous, it could at once be identified by the shape of its upper wings, the hinder margins of which are deeply cut and scalloped, very much like those of the Comma Butterfly, which has been described on page 397. The colour of the upper wings is soft brown-grey, with a downy surface, and slightly powdered with rust-red. On the middle of the wing is a broad dash of bright rust-red reaching as far as the base, and having a tiny, but conspicuous spot of pure white in its middle. Parallel with the hind margin a whitish-grey line runs across the wing and has a narrow, pale brown streak accompanying it. The front of the thorax is furnished with a ruff of long, soft down, of the same rust-red as that of the wing. The rest of the body and the lower wings are greyish-brown. The caterpillar, which is shown at Fig. *a*, is green, with a narrow grey streak along the sides. It feeds on the Sallow, and when full-fed spins a cocoon within two or three of the leaves, which it draws together with silk.

The popular name of Herald is given to this Moth because it appears at the end of autumn, and is supposed to be the herald of the coming winter. Though feeding in the open air, it has a singular predilection for the habitations of man, and contrives to make its way into stables, outhouses, and even into houses that are inhabited. It is one of the commonest of the many window Moths, and often causes great consternation among thrifty but ignorant housewives, who think that it has come for the purpose of eating their woollen clothes, their furs, and their feathers, and that, as it is so much larger than the common Clothes Moth, it will eat so much the more. The name of Gonoptera, or Angle-winged, refers to the bold scalloping of the upper wings.

Mr. Newman remarks that these Moths often make up their minds to hibernate almost immediately after they have passed from the pupal shell, and that in that case, when they have settled in a house, they remain in the same spot until the following spring, passing the whole of the time in a state of torpidity.

Just as one group of Moths is popularly termed the Yellow Underwings, so is another termed the Red Underwings, the ground colour of their lower wings being brilliant red.

The first of these splendid insects is the RED UNDERWING (*Catocala nupta*), which is represented on Woodcut XLVIII. Fig. 2. This is one of the largest and handsomest of the group, though its colours are not quite so brilliant as that of another species which will be presently mentioned.

The upper wings are grey with a slight yellowish tint, and profusely covered with waved bars and other marks of black, nearly every such mark being accompanied by a grey bar of similar shape. The under wings are red, diversified with two black bars, one, a very broad one, parallel to the hind margin, and another, a comparatively narrow and much curved bar, running across the middle of the wing. Beneath, the upper wings are white, crossed by three broad black bars, and the lower wings are similarly coloured, but warming into light red towards the inner margin, and having two bars across them.

The caterpillar is grey in colour, not unlike the hue of the upper wings of the perfect insect, and sometimes has two black waved stripes on the back. I never saw this caterpillar, but Mr. Newman's account of its habits is so admirable that I transfer it to these pages:—

‘It feeds on the Crack Willow (*Salix fragilis*), and, when closely adherent to the bark, is almost impossible to detect. I have sometimes found it by passing my hand gently over the surface of the bark about a foot below the branches of a pollard willow, when its cold, soft feel at once betrayed it. It spins a network cocoon among the leaves, or in a crevice of the bark about Midsummer, and changes to a smooth chrysalis covered with a purple bloom.’

The perfect insect appears about August; and, though it may be common, it is not often seen, owing to its mode of concealment. It carries into its perfect state one of its caterpillar habits, and has a way of settling on the trunks of willow trees and closing its wings. In this position the splendid red under wings are completely hidden by the sombrely tinted upper pair, which so exactly resemble the colour of the bark that, even when the Moth is pointed out, very few can distinguish it. I well remember the first time of discovering one

of these beautiful Moths. I was going to bathe in the river Cherwell, near Oxford, a river which is bordered with willows. I happened to place my hand on the trunk of one of the willows, when out bounced a grand Red Underwing, startling me as much as a novice in shooting is startled by his first pheasant. I afterwards found that the Moths were tolerably plentiful upon these trees.

The generic name *Catocala* is formed from the Greek, and signifies something which is beautiful beneath. The name has been given to these insects because their chief beauty lies in the under wings, which are hidden beneath the upper pair when the Moth is at rest.

On the Frontispiece may be seen a portrait of a smaller but more richly coloured species, called the LIGHT CRIMSON UNDERWING (*Catocala promissa*).

In this fine Moth, the upper wings are coloured much like those of the preceding species, but the marblings are much richer and more clearly defined, and on the middle of the wing there is a decided ochreous tinge. There is considerable variation in the aforesaid markings. The ground colour of the lower wings is crimson, with a very broad black band following the hind margin, and a narrow band crossing the middle, and almost angular in its form.

The caterpillar feeds on the oak, and is greenish-grey in colour, and covered with tubercles of a warmer hue. 'It is full-fed in June, and spins a web among the leaves, appearing as a perfect insect in a month or so. This is not nearly so common an insect as the Red Underwing, but has been found in most of the southern counties of England, the New Forest being noted as its best locality.

To the same genus belongs that magnificent insect which is so very common in France and so very rare in England, the CLIFDEN NONPAREIL (*Catocala fraxini*). This Moth can at once be recognised by its superior size and the colour of its under wings, which are black, with a broad band of bluish grey drawn through their centre. It is believed by many practical entomologists that this insect does not rightly belong to England, but that those few specimens which have been taken within the limits of our island have been blown across the Channel from their legitimate home in France.

CHAPTER V.

DELTOIDES, PYRALIDES, AND CRAMBITES.

I VERY much regret that there should be no simpler words which can be substituted for those which head this chapter. There are, however, none whatever, so we must be content to use the terms which are adopted by the best entomologists of the time. Indeed, the only group of which it is even possible to form a simple English word which fully expresses the character of the insects, is the first, which literally signifies Delta-like, and may be freely translated as Delta-Moths, because when the insects are at rest, their wings assume a shape which bears some resemblance to the Greek letter Delta (Δ). All the above-mentioned insects are small, but the number of species is enormous, for they reckon among their ranks more species than all the groups which have heretofore been described. As is the case with the Noctuæ, the Moths of each group bear a great resemblance to each other, and much afflict the mind of the collector by their prevailing similitude. At first, the collector finds himself utterly bewildered, when brought in contact with a number of these Moths, and a feeling of despair seizes upon him. He feels much as if a flock of sheep were brought before him, and he were required to distinguish and name every animal. However, remembering that a good shepherd actually does know by sight every sheep in his flock, and that his eye can seize upon little points of difference which are absolutely invisible to the uninitiated, he sets determinately to work, and after a little while feels that he is beginning to make his way.

First, after long and careful examination, he picks out one individual, and succeeds in finding the points in which it differs from its fellows. Having done this, he is able to refer it to its proper place in the list, and then finds but little difficulty in

picking out any other specimens that belong to the same species. Half his task is now over, and he is able in a comparatively short time to detect in the other Moths those distinctions which his predecessors have already noticed, and by means of which their species is ascertained. In fact, just as the above-mentioned shepherd learns to know by sight, and even by name, every member of a large flock of sheep, which to the eye of a stranger are exactly alike, so does the entomologist gain the power of seeing at once the differences that exist in insects which to an unaccustomed eye seem to have no marks of distinction at all.

ONE example of the *Deltoides* will be sufficient for our present purpose, and we will select the BANDED SNOUT (*Hypena rostralis*), which is represented in the central figure of Woodcut LVI.

This is one of the Moths which have received the popular name of Snouts on account of the extremely elongated palpi, which project in front of the head so as to look very much like a proboscis. The antennæ of these insects are simple in the females and tufted in the males; their bodies are slender and furnished with a tuft on the first segment.

The present species has the upper wings of a yellowish-brown, crossed with a dark, grey-edged band. It is a common Moth, and one of the earliest to appear in spring. The caterpillar is long and slender, hairy, and when full-fed spins a silken web among leaves and then changes into a long and slender pupa, having the head portion much elongated in order to contain the 'snout' or elongated palpi. There are three species belonging to this genus, one of which, called *par excellence* THE SNOUT (*Hypena proboscidalis*), has the upper wings boldly hooked at the tips; and another, called, by a remarkable collocation of words, the BEAUTIFUL SNOUT (*Hypena crassalis*), has the upper wings dark brown, with a patch of creamy white at the base, and a rather paler border, in which are a number of little black spots, each surrounded by a ring of cream-white.

The largest and the finest species, named THE SNOUT, is drawn on Plate XVII. Fig. 1. It may at once be recognised by the peculiarity which has already been mentioned, namely, the bold, hooked tips of the upper wings. Their colour is yellowish-brown, and the markings are dark-brown. The lower wings

are simply pale-brown. The elongated and odd-looking larva of this species is shown at Fig. 2 of the same Plate. Its proper food is the common stinging-nettle.

NEXT come the PYRALIDES, which some authors class with the preceding insects. They include, among other insects, the

LVI



1. *Hypena rostralis*. 2. *Pyralis farinalis*. 3. *Aglossa pinguinalis*.
4. *Ennychia octomaculalis*. α. Larva of *Hydrocampa stagnalis*. β. Do. in its leaf-case.

Meal-Moths, and the beautiful group of Pearl-Moths, so called because the surface of their wings has a peculiar sheen, much resembling that of mother-of-pearl.

We will begin with the small group scientifically called *Pulverulentæ*, and popularly Meal-Moths, because their larvæ feed on meal, flour, and similar food. I have often wondered what such larvæ fed upon before men discovered the cultivation of corn, and the process of grinding it into flour. They must

have fed upon something, and yet it is not easy to conjecture what that something was, for there is nothing in nature analogous to flour or meal.

On Woodcut LVI. Fig. 2, is shown one of those curious insects, the common Meal-Moth (*Pyralis farinalis*). In these Moths the wings have a gloss on the surface, are rather long and narrow, and, when the insect is at rest, fall into a triangular form. The antennæ of the males are hairy beneath, while those of the females are plain.

This very pretty little Moth has the upper wings dark brown, variegated with yellowish bars, as shown in the illustration. The figure is rather magnified, in order to bring out its markings more distinctly, and the same is the case with most, though not all, of the remaining Moths.

Only three British species of the genus are known, the most familiar of which is the DOUBLE-BAR MEAL MOTH (*Pyralis glaucinialis*). It is less than the preceding species, and is scarcely so pretty. The colour of the wings is brown, across which are drawn two bands of a paler hue.

ON the same Woodcut, at Fig. 3, is drawn the too familiar TABBY MOTH (*Aglossa pinguinalis*).

The Moth is rather a pretty one. Its upper wings are yellowish-brown, with a very dark and nearly black patch at the base of each wing, and a broad stripe of the same colour running parallel with the hind margin, and much wider above than below. A narrow white streak divides the dark from the lighter portions of the wing. The lower wings are of the same pale dun as the upper pair, but they are without the dark markings, and have only two jagged narrow streaks of white near them. When the wings are expanded, these marks look as if they were continuations of the corresponding marks of the upper wings.

This may almost take rank as one of the Clothes Moths, as in the larval state it feeds on old and greasy clothing. Grease, indeed, seems to be a necessity with this insect, which delights especially in old horse-rugs that are neglected by careless grooms. The specific name of *pinguinalis* signifies fatty or greasy, and is given to the species on account of the substances on which the larva feeds.

The caterpillar, which does the mischief, is a brown creature with a hard and horny skin, and having a head darker than the rest of the body. Like the ordinary Clothes Moths, it does not meddle with articles that are either in common use or that are carefully aired and looked after. But, should a groom throw a horse-rug into a corner, and let it lie there for several days, the larvæ of the Tabby Moth find their opportunity, and make sad havoc with the cloth. When full-fed the larva makes a slight cocoon, and therein undergoes its transformations.

This genus of Moths receives the name of *Aglossa*, or tongueless, from the fact that the maxillæ, which when united form the proboscis or tongue, are almost entirely absent. The antennæ of the male are doubly feathered. Like the Meal-Moths, these insects are found abundantly in and about out-houses. There is only one other British species of this genus, namely, the SMALL TABBY (*Aglossa cuprealis*). As its name implies, this is a smaller species. The wings are of a light-brown colour, and across them are drawn some indistinct bands of coppery-brown. It is as common as its larger relative, and the larva possesses similar habits.

NEXT comes an example of another family, the Luridæ or Ennychidæ. This is the rare and conspicuous WHITE-SPOT (*Ennychia octomaculalis*), a figure of which is given on Woodcut LVI. Fig. 4. In this genus the antennæ are slender, and long in proportion to the insect, and the palpi, which are not quite so long as the head, are united, so as to form a sort of beak.

This is one of the few Pyralides which it is impossible to mistake. Both pairs of wings are deep-black, and on each wing are two whitish-yellow spots with boldly defined outlines. The hind margins of the wings have a delicate white fringe, which on the inner margin of the lower wings becomes very long and has an exceedingly pretty effect, as it contrasts with the deep-black of the wing which it edges. The body is black, and the abdomen has each segment marked by a very narrow, but very distinct white line, scarcely wider than if scratched with a needle-point. There is scarcely any difference in the colouring of either surface, except that on the lower wings the two white spots coalesce.

This singularly pretty little Moth has been found in most parts of England, but in none does it appear to be common. The specimen from which the above description is taken is from my Oxford collection, the insect having been captured in Bagley Wood. I had at one time four or five of the White-Spot Moth, all taken in the same locality.

Now we come to a very extraordinary creature.

There is one family of Moths, comprising only four species, the larvæ of which are dwellers in the water, thus trespassing on the domains of other orders of insects. There is a group of Moths popularly called China Marks, because the general character of the surface of the wing and its markings has very much of a porcelain character about it. The typical species is *Hydrocampa stagnalis*. In all these Moths, the female is considerably larger than the male, and is rather variable in her colouring, so that the older entomologists have in several cases considered the sexes as forming distinct species. The male has no feathering to the antennæ, and the palpi are short, close together, and directed upwards.

The Moths are pretty little creatures, but the chief interest of the insect lies in the larva, which has a mode of existence that seems quite opposed to the whole character of the Lepidoptera. The caterpillars feed upon aquatic plants, and in some species are absolutely sub-aquatic themselves. It is evident that the respiratory apparatus of such larvæ cannot be formed like that of ordinary caterpillars, which breathe atmospheric air through spiracles and breathing tubes. Accordingly, these larvæ, like those of the caddis, the May-flies, and one or two beetles, such as the whirlwig, all of which have been described in the course of this work, are furnished with gill-like filaments along their sides, by means of which they extract the oxygen from the water just as fishes do.

This is a most wonderful fact, and almost without a parallel in entomology. There is one species of Ichneumon-fly, called *Agriotypus armatus*, which is so far aquatic in its character that it crawls down the sides of stones and water-plants to a considerable depth, evidently for the purpose of laying its eggs in some aquatic larva. It really seems to be fond of diving for its own sake, and if kept in an aquarium will sub-

merge itself for a considerable time, the appearance of a hymenopterous insect beneath the surface of the water being most extraordinary, and always exciting the admiration and surprise of those who have any practical knowledge of insects. But, that a caterpillar should actually pass its life under the water is still more contrary to all preconceived opinions, and the idea of a water-caterpillar is not one whit more abnormal than that of a water-butterfly. The name *Hydrocampa* is formed from two Greek words, literally signifying water-caterpillar, and is given to this genus of Moths in consequence of the aquatic life of the larva.

On Woodcut LVI. Fig. *a*, is drawn one of these larvæ, being the preliminary stage of a Moth called scientifically *Hydrocampa stagnalis*. This larva feeds upon the common duck-weed (*Lemna*). It does not crawl freely upon this vegetable, but remains submerged, and protects itself after the manner of the caddis, which it so closely resembles in many of its habits, by means of a case constructed from the epidermis of the pond-weed (*Potamogeton*). From the under surface of the broad, floating leaves of this plant, the larva strips off a sufficiency to form a kind of tent, in which it resides, very much as do the caterpillars of several British Moths with the leaves of the oak and other trees. At Fig. *b*, is seen this caterpillar, with the head and legs just protruding from its case, which, being of the same colour as the aquatic plants, serves for concealment as well as for protection.

The Moths themselves are very common, and can be taken in plenty on the banks of ponds and any wet places where duck-weed, pond-weed, and water-lilies grow. The perfect insect is shown on Woodcut LVII. Fig. 1. It is popularly known as the BEAUTIFUL CHINA MARK, and well deserves its name. The ground colour of the wings is pearly-white, and on these are traced a number of soft brown lines, the most conspicuous of which is a mark near the tip of the upper wings, somewhat resembling the letter Y with the angle rounded.

WE next come to the Pearl Moths, which have already been casually mentioned, and which are placed in the genus *Botys*. A much more appropriate and withal intelligible name was

suggested by Mr. Stephens, namely *Margaritia*, from the Greek word *Margarites*, which signifies a pearl. By the way, it is evident that brunettes should never be named Margaret, the name being as inappropriate as Blanche or Lily.

The name, however, has been reluctantly rejected by entomologists, because the name of *Botys*, given to these Moths by Latreille, has the priority, and entomologists are obliged to be

LVH

1. *Hydrocampa stagnalis*.4. *Stenopteryx hybridalis*.2. *Botys urticae*.a. *Botys*, larva.3. *Spilodes cinctalis*.b. *Spilodes*, larva.

as jealous of priority as are officers of seniority. It does not matter who invents a name, or how appropriate—or the contrary—it may be. That name which is first published has the priority, and that name will be accepted ever afterwards. There is only one chance of deposing an old and inappropriate name in favour of a newer and better, namely, to prove that the old name has clearly been anticipated in some branch of zoology. If such anticipation can be shown beyond contra-

diction, the older name is by common consent abandoned, and the next in seniority takes its place. There are, of course, some disadvantages in this system, but they are enormously overborne by its advantages, for, without some such system, there would be no fixed nomenclature of insects, and every one who thought that he could improve upon a name would do so, and the result would be an inextricable confusion, which every year would augment.

In the genus *Botys*, the body is larger than the wings, and both pairs are marked in a similar manner.

The colour of this pretty little Moth is pearly-white, on which are a number of dark markings arranged as shown in the illustration on Woodcut LVII. Fig. 2. The popular name of this insect is the MOTHER OF PEARL, and its scientific name is *Botys urticalis*.

Although the general character of these marks is the same in all species, there is some variation in different specimens, both in their arrangement and depth of tint. In colour they are nearly black, but if viewed by a side light, a purplish metallic gloss is seen upon them, being best defined along the costal margin of the upper wings. Both surfaces are coloured in much the same manner, but on the under surface the marks are not so dark, and the purple gloss is more conspicuous, especially on the lower wings. When closed, the wings assume a heart-like shape, and usually look very round, as if a flat plate of thin mother of pearl had been cut into the shape of a heart, and carefully painted with dark spots. The thorax is bright golden-yellow, the abdomen is black, each segment being edged with yellow, and there is a tuft of yellow hairs at the end of the tail.

The caterpillar is one of the numerous nettle-feeders. It is thicker in the middle than at the ends, and so thin-skinned that it has a semi-transparent appearance when viewed against the light. Its colour is whitish-grey on the back, relieved by a central black line, and the sides are green. This larva is shown at Fig. *a* on Woodcut LVII. It draws together the leaves of the nettle with silken threads, and so feeds in concealment. There are ten species of this pretty genus.

On Woodcut LVII. Fig. 3, is seen the Moth which is popularly called the LESSER PEARL (*Spilodes cinctalis*).

By the older entomological writers this insect was comprised in the same genus with the preceding insect. It has now, however, been placed in a different genus, and that for two reasons. The first lies in the shape of the wings, which are much deeper in proportion than those of the insects belonging to the genus *Botys*; and the second is the appearance of the wings, which do not possess the delicate, pearly translucency which is so characteristic of these Moths, but are quite opaque, their opacity being due to a very dense layer of white scales on the under surface.

The general character of the markings can be seen by reference to the illustration. The darker portions are, however, of various degrees of depth, and the light portions are glossy cream-white, sometimes taking a yellow tinge. The generic name *Spilodes* is taken from the Greek, and signifies anything that is spotted. The specific name, *cinctalis*, or banded, alludes to the manner in which the spots are arranged, so as to form almost continuous bands.

The caterpillar of this insect is seen at Fig. *b*.

Another pretty insect, belonging to the same genus, is the DIAMOND SPOT (*Spilodes sticticalis*).

This little Moth is brown, the upper wings being much darker than the lower, and having a conspicuous spot of pure white near the tip. It is a rare Moth, but has been taken in many parts of England, always appearing about September. The caterpillar is shaped like that of the preceding species, and is green, having along its back a dark line edged with yellow, and some streaks of the same colour at the sides. It feeds on the field-southernwood (*Artemisia campestris*) or the mugwort (*Artemisia vulgaris*).

WE now come to the last group of the Pyralides. These insects have been termed *Plicatæ*, or folded, because when the insect is at rest the wings are folded closely against the body.

One example of this group will serve our purpose, namely, the RUST VENEER (*Stenopteryx hybridalis*). There is only one British genus of these insects, and the name of *Stenopteryx* or 'Shortwing' has been given to it, not so much because the wings are exceptionally short, as because the abdomen is ex-

ceptionally long, making the wings look short in proportion. This insect is drawn on Woodcut LVII. Fig. 4.

The upper wings of this species are rather narrow, and their colour is brown, with some rather large spots of a deeper brown. The lower wings are plain grey-brown. When the insect is in repose, the upper wings overlap each other, the end of the abdomen just appearing beyond them. The male is distinguished by having his antennæ feathered, while those of the female are plain and thread-like. Although this is a very common Moth, I can find no mention of the larva, and do not myself know it.

THE next group of Moths which comes before us is called CRAMBITES, this name being apparently derived from a Greek word signifying a kind of caterpillar. Whether or not this is the case I cannot say, but the word has long been accepted by entomologists. The reader will notice that all Moths which belong to this group have their specific names ending in 'ellus' or 'ella,' according to the gender of the generic name.

WE will begin with an example of the typical genus, namely, the PEARL-STREAK VENEER (*Crambus hamellus*). It is drawn on Woodcut LVIII. Fig. 2. In all the insects belonging to this genus, the labial palpi are very long, and at first sight look very much like a beak, or short proboscis. The upper wings are long, narrow, and convoluted in repose, and the antennæ are thread-like.

This beautiful little Moth is rather gaily coloured. The ground hue of its upper wings is rich dark brown, and parallel with the costal margin and just below it is drawn a narrow streak of pearly white, from which its popular name is derived. The hind margins of the wings are yellow, that colour being separated from the brown by a dark, wavy bar. The lower wings are much lighter in colour than the upper pair, and not nearly so handsome, their colour being pale grey-brown, with an edging of yellow like that of the upper pair.

It is not a very common Moth, but can be taken in open places in woods by beating the bushes. It makes its appearance in the very midst of summer.

ON Woodcut LVIII. Fig. 3, is shown an example of the family Chilidæ—a word which by rights ought to be spelt as Cheilidæ. It is derived from a Greek word signifying a beak or snout, and is given to these insects because the labial palpi are very long, as long in fact as the head and thorax together, and project from the head like a beak. This great development of the palpi is well shown in the illustration, those organs being so long as almost to look like a second pair of antennæ. The upper wings of these Moths are lancet-shaped, long, and comparatively narrow.

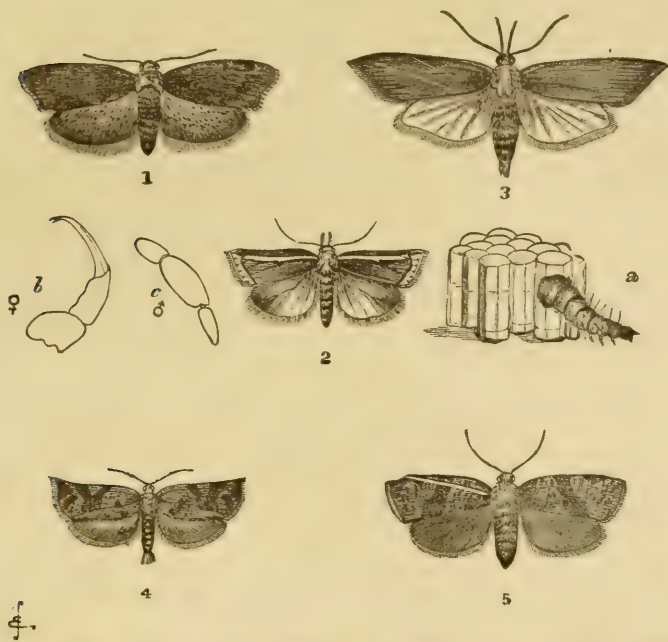
The present species is called the WAINSCOT VENEER (*Chilo phragmitellus*), and is one of the largest, if not the very largest of the family. Its colour is nearly uniform pale yellow dun, with a slight streak or dash of a darker hue just below the costal margin of the upper wings. Both pairs of wings are nearly of the same colour. The male may be known from the female by having the antennæ slightly feathered and the wings longer, narrower, and more sharply pointed.

The caterpillar is coloured much like the perfect insect, but has not so much of the yellow about it, except on the head and following segment, which are orange brown. It feeds on the common reed (*Arundo phragmites*)—whence its specific name of *phragmitellus*—and only in places where that plant grows, and where in consequence the coot and the reed-bunting abound, can either the caterpillar or the perfect insect be taken. Although the reed is plentiful in its own chosen localities, it is very particular as to the place of its growth. Mostly it grows on marshy lands, or in waters which are very shallow and occasionally exposed to the air in hot and dry summers. Whittlesea Mere is one of the places where the Wainscot Veneer can be taken; and I should fancy that the great reservoir at Swindon would be a likely place for it, as the reed grows there in large patches, forming semi-islands in the water.

At a little distance these islands look very easy of approach, and the coots' nests in them appear as if anyone could just step in and take them; but to penetrate the stronghold of the coot is not always so easy as it looks, for the tall, sturdy reed-stems form a natural stockade, strong enough to prevent a human being from forcing his way through them, but not strong

enough to bear his weight. Even if a boat be rowed hard at one of these semi-islands, it often fails to penetrate it, the reeds partly yielding to the impetus, and then recoiling and driving the boat back with no small violence. Such places as this are the localities loved by the Wainscot Veneer, and any one who wishes to obtain it should visit them in June and July for the perfect insect, and in May for the full-fed caterpillar.

LVIII



1. *Galleria cerella*. 2. *Crambus hamellus*. 3. *Chilo phragmitellus*. 4. *Tortrix costana*. 5. *Tortrix sorbiana*. a. *Galleria*, larva. b. Do., palpus of female. c. Do., palpus of male.

There are a tolerable number of Moths called by the popular name of Veneers, the largest of which is the GIGANTIC VENEER (*Schœnobius gigantellus*). An exceptionally fine specimen of this insect will measure almost two inches across the spread wings. In colour this insect very much resembles the Wainscot Veneer, but there is a decided difference in the colour of the sexes. The male has both pairs of wings bright yellow-brown, and the upper pair slightly spotted; whereas those of the

female are pale brown without the spots, and the under wings are nearly white.

Like the preceding insect, this Moth is rare except in places where the reed abounds. The somewhat odd-looking name *Schœnobiæ* alludes to this fact, and is derived from two Greek words signifying something that lives among reeds. Several other of the Veneers belong to the genus *Crambus*, which has already been mentioned.

THE last of the Crambites which we can examine is an insect with which all bee-keepers would very gladly dispense, as it plays much the same part with the bee-comb that the Clothes Moth does with wool, fur, or feathers. This is the little insignificant-looking HONEY-COMB MOTH (*Galleria cerella*), a figure of which is given on Woodcut LVIII. Fig. 1. The specific name of *cerella* (from the Latin word *cera*, wax) has been given to this insect in consequence of the wax-eating propensities of the larva. Linnæus, being deceived by the structure of the palpi, gave to the male the specific name of *cereana*, and to the female that of *melonella* (from the Latin, *mel*, honey). So, in order to avoid confusion, both these names have been rejected, and the present specific name accepted in their stead.

The colour of this Moth is simply brown, the lower wings grey-brown, the upper pair having a tinge of chestnut. They are rather boldly scooped at the tips, in which respect they differ from those of one or two other Moths, which will presently be mentioned.

Personally, I have a very strong objection to this Moth, and cannot easily forgive it for the destruction of a valuable collection of bee-combs. I well remember my dismay at discovering the havoc which this insect had made in a very short time. The cases containing the combs had been put away for some months, until I had to refer to them. On opening the cases, I was dismayed to find that the combs had almost entirely disappeared, and in their place was a complicated mass of long silken tubes, running in all directions, and swarming both with the caterpillar and perfect insect of the Honey-comb Moth. The rapidity with which they form their galleries is really wonderful, and the caterpillars appear even to extend them

where they are not required. I could very easily understand why they should drive their silken tunnels through the combs, or even on their surface, but I never could see any object in the extraordinary excursions in which they continually indulged. The silken tubes ran all over the box, extending to spots far distant from the comb. One of these tubes had actually been made between the lid and the edge of the box, and ran for nearly the whole distance, so that when the box was opened, the tube was torn asunder for nearly the whole of its length, and its inmate was discovered, much to its discomfiture.

The object of the tubes is evident. The body of the caterpillar is quite soft, and the only parts that are at all hard are the head and thorax. The aggrieved bees would be sure to destroy the invader of their hives if they could only get at it, but the horny skin defends the one end of the caterpillar, while the other is sheltered in the tube, and the consequence is, that the bees are powerless and often are driven out of their hives by this little Moth. I have often wondered that the bees never seem to think of tearing up the silken tubes and turning the caterpillars out of them. The tubes may resist the sting of the bee, but, although they are tough, they are not so strong that the strong jaws of the bee could not pull them to pieces.

The caterpillar proceeds in its tube-making in a very systematic way. It thrusts its head out of the end of the tube, and eats the cells and their contents until it cannot protrude itself further without exposing the soft part of its frame. So it sets to work and adds to the tube until it has brought it close to its food, and thus proceeds until it is full-fed, and the time arrives for it to undergo its transformation. The caterpillar is marvellously active when within its tube, and can run backwards as fast as it can forwards. On the least movement near it, the caterpillar takes alarm, and jerks itself backwards into the protecting tube with a movement exactly resembling that of a frightened tortoise drawing its head into its shell.

A figure of the caterpillar is shown at Fig. *a* of the Woodcut LVIII. in the act of forcing its way through the honeycomb. The reader must remember that the silken gallery is of necessity omitted, as otherwise the caterpillar could not be

shown. I have watched these larvæ carefully, and never yet saw one of them protrude itself further from the mouth of the tunnel than it could be protected by the hard covering of the head and the next three segments.

With regard to my own specimens of devoured combs, there was good reason for the vast number of caterpillars. They came from a hive nearly all the inhabitants of which had died in the winter, so that the Honey-comb Moths found no difficulty in getting among the combs, and depositing their eggs when and where they liked.

In this insect the sexes may be at once distinguished by the very different structure of the palpi. Fig. *c* shows the palpus of the male, and Fig. *b* that of the female.

This is not the only species of Moth that feeds on the honey-comb. There is, for example, the GREEN-SHADED HONEY-COMB MOTH (*Melia sociella*), which is rather more gaily coloured than the preceding insect, and has on the disc of its upper wings a yellowish streak spotted with black dots; and the HONEY MOTH (*Achroia grisella*), a much smaller species, having brown wings covered with tiny black dots. All the caterpillars of the comb-eating Moths possess similar habits.

CHAPTER VI.

TORTRICES, TINEÆ, AND PTEROPHORI.

THE Tortrices or Twisters are so called because many, though not all of them, are in the habit of twisting or rolling up leaves while in the larval state. Of these insects, a vast number of species are already known, and new species are continually being brought forward for investigation. There is, however, so great a resemblance between the different species, and each species is so apt to run into varieties, that all systematic entomologists look with suspicion on any newly announced species of this group, and the discoverer is sure to be sharply challenged as to his proofs of its novelty. So extremely variable are some of these Moths, that in one case no less than thirty-seven alleged species have been reduced to one, and shown to be merely varieties; while in another species twenty-three varieties have been detected, and in another, fourteen.

There is little difficulty in knowing whether a Moth belongs to this group. In these, the body is comparatively short and slender, and the wings have a peculiar wave on their costal margin, so that when the insect is at rest with closed wings, the outline is curiously like that of a bell. We will take a few of the most conspicuous of these Moths.

At their head come some Moths which scarcely seem to belong to the Tortrices. They are popularly called by the name of Silver Lines, because their green wings are crossed with some narrow lines of silvery-whiteness. As a rule, the Tortrices are all little Moths, but some of the Silver-Lines are exceptions to this rule, and are, indeed, the very giants of their race.

There are but three of these insects, which form the family of the Cymbidæ, a name which will be presently explained.

The commonest of them is the GREEN SILVER LINES (*Halias fraxinana*). The upper wings of this Moth are beautiful leaf-green, across which are drawn three diagonal silvery lines, taking a pinkish hue near the inner margin. The head and thorax are of the same green hue as the wings. The lower wings and abdomen are pale yellow. The larva of this insect feeds on the oak, the ash, and one or two other trees, and the perfect insect appears in May. The middle of July is a good time for taking the larva, as it is then nearly full-fed. The colour of the caterpillar very much resembles that of the Moth's wings. This Moth measures about an inch and a half in the spread of its wings.

The largest of all these Moths is the SCARCE SILVER LINES (*Halias quercana*), which measures about two inches in expanse of wing. The upper wings of this species are leaf-green, and are crossed by two diagonal silvery lines, nearly but not quite parallel with the hind margin. The caterpillar of this insect should be sought for in May, the perfect insect appearing towards the end of summer.

When the caterpillar is full-fed, it changes into a chrysalis, which is fastened to a leaf. The form of the chrysalis is most peculiar, and has been compared to that of a boat with the keel uppermost. The name of Cymbidæ, which has been given to this family, is taken from a Greek word signifying a boat, and alludes to this form of the pupa.

WE now proceed to the typical family, the Tortricidæ, of which we shall take a few examples, the first of which is the HAZEL MOTH (*Tortrix sorbiana*), a figure of which is given on Woodcut LVIII. Fig. 5.

This is the largest of its family, and is rather a conspicuous insect, its colours being boldly contrasted. The general character of these markings is shown in the illustration, but they vary so much in direction, shade, and dimensions that scarcely any two specimens are exactly alike. The colour of the upper wings is light warm brown, upon which are some bold marks of dark brown. These are mostly three in number, namely, a rather jagged band across the middle of the wing, another near the base, and a triangular spot near the tip, the base resting on the costal margin. The male may be known



PLATE XVII.

DELTOIDES, TORTRICES, TINEÆ, AND PTEROPHORI.

1. *Hypæna proboscidalis*.
2. *Hypæna proboscidalis*, larva.
3. *Tortrix pomonana*.
4. *Tortrix pomonana*, larva.
5. *Pterophorus pentadactylus*
6. *Pterophorus pterodactylus*.
7. *Nepticula aurella*.
8. Leaves mined by *Nepticula*.

PLANTS:—

Apple and Bramble.



by the formation of his upper wings, which have a narrow fold that reaches nearly to the middle.

As its popular name imports, the caterpillar of this Moth feeds mostly on the hazel, though it is found on other trees. It is not one of the actual leaf-rollers, but draws the leaves together with silk, and feeds snugly between them. The caterpillar is full-fed about the end of April or beginning of May, according to the weather, and the perfect insect appears in June.

THE very pretty, but very destructive PEA-GREEN MOTH or OAK-MOTH, as it is indifferently termed, requires a short notice. The scientific name of this insect is *Tortrix viridana*. The appearance of this little Moth is very prepossessing, the upper wings being leaf-green, and the lower pair greyish-brown. When the wings are closed, the green is the only portion of the insect that is visible, so that the Moths may be thickly spread over a branch, and yet not one be distinguishable from the leaves. This insect is in some years very destructive among the oak trees. It may be found in abundance at the beginning of summer, in any place where oaks are numerous.

NEXT comes the STRAW OBLIQUE BAR (*Tortrix costana*), which is seen on Woodcut LVIII. Fig. 4.

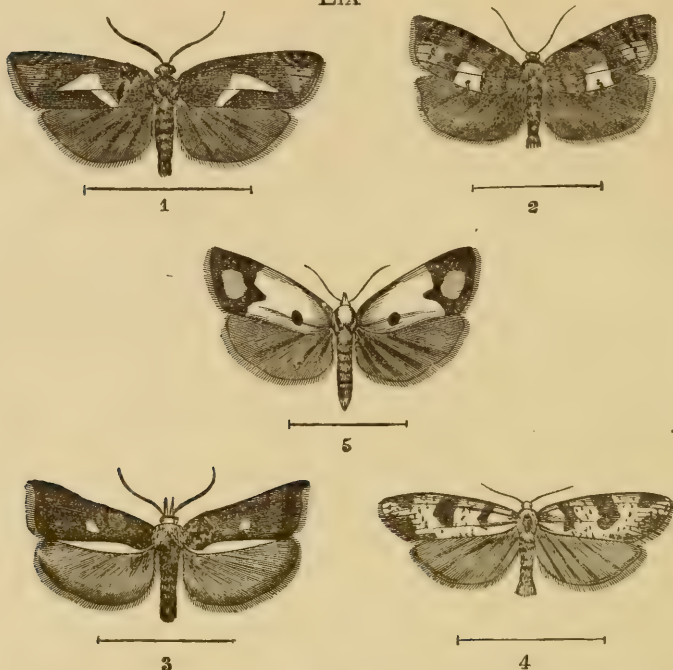
This pretty Moth derives its popular name from the colouring of the wings. The upper pair are a very glossy straw-colour, sometimes taking rather a pale tint. Upon them are some markings of rather dark warm brown, arranged as shown in the illustration. There is some variation in different individuals, but the central bar, which runs obliquely, is most distinct at the costa. The other markings are not so distinct. This is a common insect in nearly all marshy places, as the larva feeds upon almost any plants that grow in such situations. The colour of the caterpillar is dull brown, and its head is black.

PASSING by a number of species, we come to the BUTTON TORTRIX (*Peronea cristana*), which is shown on Woodcut LIX. Fig. 3.

This is the insect of which so many varieties have been recorded. So variable an insect cannot be described in detail,

but there are one or two points about it which are the same in all the varieties. The upper wings are always brown of some shade, and much darker than the lower pair. Each of the upper wings has in the middle a little button-like tuft of greyish-white scales, from which the popular name of Button Moth is derived; and along the lower edge of the wings there is a streak or dash of the same hue.

LIX

1. *Ephippiphora fænella*.2. *Ephippiphora scutulana*.3. *Peronea cristana*.4. *Cnephasia octomaculana*.5. *Xanthosetia zoegana*.

This Moth is not rare, though it is rather local, occurring in some profusion in those spots wherein it takes up its residence. Woods and forests are the localities which it generally prefers, and it appears from the end of summer throughout the autumn.

THE very conspicuous NOTCHWING (*Teras caudana*) deserves a short description, on account of the peculiarity of the upper

wings. If one of these wings be taken by itself, it looks exactly as if the insect had met with an accident, and had a large piece torn out of the upper edge. This notch, from which the insect takes its name, occupies fully one-third of the length of the wing, and is rather deeper towards the base than the tip. It is rather a variable insect, but the deep and long notch is sufficient for identification. Generally, the ground colour of the upper wings is soft grey-brown with a satiny gloss. About the centre of the wing the colour warms into chestnut, and a narrow edging of the same colour surrounds the wing. The edge of the scallops is white, and a dark grey band is drawn beneath them, and taking the same outline.

The caterpillar of this little Moth feeds on the willow, and is green, with a yellow head. The Notchwing prefers the north of England to the south.

On the rose-tree is often seen a little white caterpillar with a black head. If approached quietly, it can be detected while feeding on the leaves, but if the branch be jarred, the caterpillar drops for some distance, letting itself down by a silken line. This is the larva of a very destructive little Moth, called the BERGMANNIAN TORTRIX (*Dictyopteryx Bergmanniana*).

The upper wings of this insect are rather long, and their upper edge is decidedly arched in front. The colour of these wings is grey with a dash of ochreous yellow, pencilled indistinctly with brown, and across them are drawn two diagonal whitish marks having a silvery lustre. On the hind margin there is a brown band, variegated with minute white spots. The best way of getting rid of the insect is to tap the stem of the rose gently, when the larvæ will let themselves drop, and can easily be taken as they hang suspended by their silken lifelines.

ABOUT the exact position of the little Moth which comes next on our list there has been considerable uncertainty, some entomologists placing it in the genus *Lozotænia*. As, however, we accept in this work Mr. Doubleday's well-known catalogue, we place it in the position which he gives it. The popular name of this Moth is the AFTERNOON TORTRIX, and its scientific title *Cnephasia musculana*. Both these names refer to its colour, the former word being taken from the Greek, and signifies

dusky, or anything which comes out in the dusk ; while the latter name is Latin, and signifies a little mouse, in allusion to the nocturnal habits of the mouse.

The upper wings of this insect are dull grey. At the base is a patch rather darker than the ground colour of the wing, and very indistinct. The central band is dark-brown with a greyish tint, the other marks are light-grey brown. The larva of this Moth feeds on the common bramble, drawing two leaves together with silk, and remaining hidden between them. The Moth is tolerably plentiful.

ANOTHER species of this genus is the EIGHT-SPOT MOTH (*Onephasia octomaculana*), a figure of which is given on Woodcut LIX. Fig. 4.

Although its colours are simple, they are very pleasing and prettily arranged. The ground colour of the upper wings is white, minutely speckled with grey, and each wing has four dark greyish-black marks, from which the insect derives its name of *octomaculana*, or eight-blotched. There is some variation in the size and form of the marks, but as a rule they are found as they appear in the illustration. The under wings are simply grey.

The larva of this insect feeds on the thistle, and is more common in Scotland and the northern parts of England than in the southern counties.

It is with much regret that I find myself obliged to omit many insects which are well deserving of notice. Our space, however, is so rapidly diminishing that we must content ourselves with only a very few out of the many pretty little Moths which form this large group.

Another of the rose-feeding pests is the caterpillar of the Moth which goes by the popular name of the BROWN CLOAK (*Spilonota roborana*).

In the insects belonging to this genus the upper wings are very narrow, being twice as long as they are broad. The hind wings, however, are so wide that they carry off the narrowness of the upper wings, which none but a practised eye would notice. The palpi are broad and flattened, and the male is known from the female by his tufted abdomen.

This is a pretty Moth, though the colours are very simple

The upper wings are creamy white, with a large triangular patch of dark-brown at the base, and a blotch of lighter brown at the tip. The space between these dark patches is mottled with blackish-grey, and there are one or two black spots scattered about it. The under wings are pale greyish-brown. The larva of this Moth can be found about the end of April or May, and the perfect insect appears in June.

Closely allied to this is another rose-eater, the CREAM SHORT-CLOAK (*Spilonota ocellana*) which derives its popular name from the creamy white of the upper wings, and the bold brown spots upon them. It is a very pretty little insect. The upper wings are, as above-mentioned, of a creamy-white, and upon them is a large, dark-brown patch at the base, occupying more than a quarter of the wing. A bold spot of the same colour is placed at the tip of the wing, and another at the middle of the inner margin, a similarly shaped spot, but of dark-grey, occupying the middle of the costal margin. The spots are, however, exceedingly variable, both in number, form, and position. The lower wings are plain dark-brown.

NEXT on our list comes the lovely, but destructive CODLIN MOTH (*Tortrix* or *Carpocapsa pomonana*), which is drawn on Plate XVII. Fig. 3.

This is a most exquisitely coloured insect, but a magnifying glass and a good light are required in order to bring out all its beauties. The upper wings are rich brown, banded at the base and tip with a darker and warmer brown. In the dark band at the tip of the wing is an oval mark of brilliant gold-coloured scales, having a very dark centre. In certain lights this dark centre takes a reddish hue, while a golden gloss pervades the whole of the wing. Even the outer wings, when viewed in a side light, shine as if made of the richest satin. By a proper adjustment of the light, a rather curious effect can be produced, the wings of one side glittering and shining in full splendour, while the corresponding wings of the other side are nothing but dull grey, brown, and black.

So excellent a description of the ravages of this little Moth is given by Mr. E. Newman in his 'Letters of Rusticus' that I cannot do better than allow so excellent an observer and so amusing a writer to speak for himself:—

‘It is the most beautiful of the beautiful tribe to which it belongs; yet from its habits not being known, it is seldom seen in the Moth state, and the apple-grower knows no more than the man in the moon to what cause he is indebted for his basketfuls of worm-eaten windfalls in the stillest weather.

‘To find the Moth in the daytime, the trunks of the apple-trees should be carefully looked over; or if your orchard be surrounded by a wooden fence, the Moth may often be found sitting against it, with its pretty wings neatly folded round its body. Towards evening—in fact, at sunset—it begins to move, and may then be seen hovering about the little apples, which by the time the Moth leaves the chrysalis—the middle of June—are well knit, and consequently fit for the reception of the eggs, which it lays in the eyes, one only in each, by introducing its long ovipositor between the leaves of the calyx, which form a tent above it, that effectually shields it from the inclemency of the weather, or any other casualty.

‘As soon as the egg hatches, the little grub gnaws a hole in the crown of the apple, and soon buries itself in its substance; and it is worthy of remark that the rind of the apple, as if to afford every facility to the destroyer, is thinner here than in any other part, and consequently more easily pierced. The apple most commonly attacked is the codlin, a large, early sort, which ripens in July and August.

‘The grub, controlled by an unvarying instinct, eats into the apple obliquely downwards, and, by thus avoiding the core and pips, in no way hinders its growth. At first it makes but slow progress, being little bigger than a thread, but after a fortnight its size and operations have much increased; it has now eaten half way down the apple, and the position of the hole at the top, if the apple continue upright, or nearly so, is inconvenient for a purpose it has up to this time been used for, that is, as a pass to get rid of its little pellets of excrement, which are something like fine sawdust or coarse sand. Another communication with the outer air is therefore required, and it must be so constructed as to allow the power of gravity to assist in keeping it clear; it is accordingly made directly downwards towards that part of the apple which is lowest, and thus the trouble of thrusting the pellets upwards through the eye of the

apple is saved, and a constant admission given to a supply of air without any labour.

‘The hole now made is not, however, sufficiently open for an observer to gain by its means any knowledge of what is going on within; this is only to be obtained by cutting open a number of the apples as they gradually advance towards ripeness; the hole is, however, very easily seen, from its always having adhering to it on the outside an accumulation of little grains which have been thrust through.

‘Having completed this work the grub returns towards the centre of the apple, where he feeds at his ease. When within a few days of being full-fed, he, for the first time, enters the core through a round hole gnawed in the hard, horny substance which always separates the pips from the pulp of the fruit, and the destroyer now finds himself in that spacious chamber which codlins in particular always have in their centre. From this time he eats only the pips, never again tasting the more common pulp which hitherto had satisfied his unsophisticated palate; now nothing less than the highly-flavoured, aromatic kernels will suit his tooth, and on these for a few days he feasts in luxury.

‘Somehow or other, the pips of an apple are connected with its growth, as the heart of an animal with its life: injure the heart, an animal dies; injure the pips, an apple falls. Whether the fall of his house gives the tenant warning to quit, I cannot say, but quit he does, and that almost immediately; he leaves the core, crawls along his breathing and clearing-out gallery, the mouth of which, before nearly closed, he now gnaws into a smooth, round hole, which will permit him free passage without hurting his fat, soft, round body; then out he comes, and for the first time in his life finds himself in the open air. He now wanders about on the ground till he finds the stem of a tree; up this he climbs, and hides himself in some nice little crack in the bark.

‘I should remark, that the fall of the apple, the exit of the grub, and his wandering to this place of security, usually take place in the night-time. In this situation he remains without stirring for a day or two, as if to rest himself after the uncommon fatigue of a two yards’ march; he then gnaws away the bark a little, in order to get further in out of the way of

observation ; and having made a smooth chamber big enough for his wants, he spins a beautiful little milk-white silken case, in which, after a few weeks, he becomes a chrysalis, and in this state remains throughout the winter and until the following June, unless some unlucky, black-headed tit, running up the trunk, peeping into every cranny, and whistling out his merry see-saw, happen to spy him, in which case he is plucked without ceremony from his retreat, and his last moments are spent in the bird's crop ; but, supposing no such ill-fortune betide him, by the middle of June he is again on the wing, and hovering round the young apples on a midsummer evening as before.

‘By burning weeds in your garden at this time of year, you will effectually drive away this little Moth. If you have trees the crops of which you value, make a smoking (mind ! not a blazing) fire under each ; it will put you to some inconvenience if your garden be near your house, but the apples will repay you for that.’

Despite these destructive habits of this insect—perhaps in consequence of them—I have always cherished a kindly reminiscence of this Moth. When I was a child there was a remarkably fine codlin apple-tree in the garden, the fruit of which ripened early and was particularly juicy. As children, we were not allowed to gather the fruit at our discretion, but were permitted to take that which fell without any unfair means being used, such as beating or shaking the branches. Thanks to the Codlin Moth, a considerable number of apples always did fall annually, having ripened much before their time, as is the manner of fruit which will never come to perfection. Like most larvæ which never see the light until they are full-fed, the caterpillar of this insect is nearly colourless, with the exception of the head, which is brown-black, hard, and shining.

ON Woodcut LIX. Fig. 2, is seen a magnified representation of a Moth known by the popular name of the SINGLE BLOTCH (*Ephippiphora scutulana*).

It derives its name from the rather peculiar colouring of the wings, the upper pair of which are brown, variously mottled, and each having on the inner margin a single square blotch of white. It is a plentiful insect in all parts of England.

An allied species, *Ephippiphora fanella*, is shown at Fig. 1. It is a very pretty little creature, the upper wings being dark brown, each having a pretty white spot, as seen in the illustration. The under wings are nearly as dark as the upper pair.

WHILE we are engaged on this subject of Tortrices that are destructive to fruit, we must mention the WEBERIAN TORTRIX (*Semasia Weberana*), which affects the various stone-fruit just as the Caddis Moth attacks the apples.

I scarcely know a more lovely Moth than this little being, its beauties, however, being so minute that they can scarcely be even suspected until the magnifying glass is brought to bear upon them. When viewed with a moderately powerful lens and a good light, the upper wings start into sudden and unexpected beauty. Their rich, satiny warm brown surface is seen to be covered with innumerable tiny and delicate pencillings, scarcely wider than a hair, but each traced with perfect decision, and glittering as if it were formed of highly burnished gold.

Although belonging to the Tortrices, it is not a leaf-roller, nor even a fruit-eater, but restricts itself to the inner bark, on which it seems to feed exclusively. Although thus hidden from human sight, it can easily be detected, because, like the Codlin Moth, it ejects from the mouth of the burrow the digested remains of its food, which may be seen in the form of fine yellow powder. Brushing oil into the holes has been strongly recommended as a mode of killing these mischievous caterpillars. I should think that to force a drop of oil sharply into the burrow by means of a fine syringe would be much more effectual. Oil is instantaneously fatal to insects, because it chokes up the spiracles and prevents them from breathing. But, it must first reach the spiracles, and I rather doubt whether the mere brushing oil over the mouths of the burrows would have that effect, whereas, forcing it into the tunnels with a smart push of the syringe-piston could scarcely fail of that effect.

THE last of the Tortrices which we can mention in this work is the ZOËGIAN TORTRIX (*Tortrix zoegana*).

The colouring of this insect is very bold. The ground colour of the upper wings is yellow, and the upper part of their

bases is tinged with rusty red. An irregular spot of the same colour is on the middle of the wing, just below the longitudinal fold, and the end of the wing is rust-red, with the exception of a rather large oval spot of the same yellow as the ground colour of the wing. The caterpillar of this Moth feeds on the root of the scabious. The perfect insect, though it seems to be widely distributed, is not very common anywhere.

CHAPTER VII.

TINEÆ AND PTEROPHORI.

WE now come to a vast group of Moths, some of which are moderately large, while some are so very minute that they scarcely seem to be ranked among the Lepidoptera.

The name Tineæ is taken from a Latin word signifying a Clothes Moth, and has nothing to do with our word 'tiny,' however appropriate that may be in many cases. The number of these Moths is really unknown, for there is scarcely a year in which some new species of the Tineæ is not discovered and placed on the list. Indeed, so numerous are they that they have collectively been ranked under a separate name, viz. Micro-lepidoptera, and their study has become quite a distinct branch of entomology. Their average dimensions may be seen by reference to Fig. 7 on Plate XVII., in which the beautiful little Moth called the Golden Pigmy is represented of its natural size.

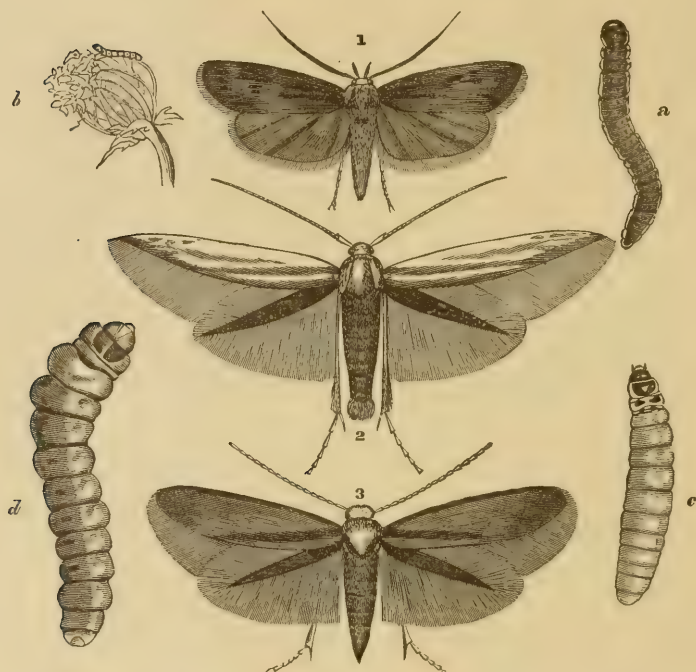
We will now proceed to examine a few examples of this group of Moths, and begin with the insect which is figured on Woodcut LX. Fig. 1. Its scientific title is *Depressaria nervosella*. No popular name has yet been given to it, so, in allusion to the peculiar colour of its upper wings, I will call it the BROWN PLUSH.

Without a magnifying glass, it is impossible to make out correctly the colours of this little Moth. The upper wings are brown, with a slight reddish gloss, and on close examination are seen to be covered with a great number of tiny longitudinal streaks of a yellowish dun. Altogether, the general effect of the upper surface of the wing is exactly like that of a piece of brown plush. The base of the upper wings is dark brown, and so is a small spot near the inner margin, and two dusk-dun spots on the disc. The fringe of the wings is greyish-dun. The lower

wings and the abdomen are grey, as is the under surface of the wings.

The larva of this insect is bluish-black, with an orange stripe on each side, and is really a handsome little creature. It feeds on the Hemlock Water Dropwort (*Ænanthe crocata*). A magnified figure of this caterpillar is given at Fig. *a* of the same Woodcut, and Fig. *b* shows the caterpillar of its natural

LX

1. *Depressaria nervosella*.*a* and *b*. *Depressaria*, larva.2. *Coleophora ibipennella*.*c*. *Coleophora*, larva.3. *Tischeria complanella*.*d*. *Tischeria*, larva.

size, feeding on the flowers of the dropwort which it has drawn together with silken threads.

I CANNOT pass unnoticed the very beautiful and very mischievous insect called by the popular name of the LITTLE ERMINE (*Hyponomeuta padella*). With respect to the first of these names, I must mention that some writers on entomology omit

the H and spell the word Yponomeuta. This practice, although it is largely indulged in by various writers, is utterly wrong, as it omits the aspirate in the Greek, the English representative of which is the letter H.

Following exactly the spelling as well as the arrangement of certain authors, I have more than once accepted this omission of the aspirate, but I can do so no longer, and hereby offer my protest against any such barbarism. The scientific names of insects are quite crabbed enough as it is, and there is no need to add to the difficulty of remembering them by false spelling.

It would be thought extremely absurd to write of burning ydrogen gas, of killing an yena, of using yperbola, of singing an ymn, of planting an yacinth, of inserting an yphen between two words, of unmasking an ypocrite or supporting an ypothesis; and yet, such words are not one whit more ridiculous than Yponomeuta for Hyponomeuta. I rather think they have been so spelt by persons more conversant with entomology than philology, and who have learnt enough Greek to know the alphabet, but not enough to know the aspirate.

In the next place the reader will remark that the specific names of the insects belonging to the Tineæ are made to end in 'ella.' The specific name of the insect just described, used to be given as *nervosa*, but has been altered to *nervosella* for the sake of uniformity.

It is impossible to mistake the little Ermine, whose long, narrow, satiny white upper wings, sprinkled with black dots, render it exceedingly conspicuous. The destruction wrought by this little insect is almost incredible, whole trees being stripped of their foliage, and, instead of bearing leaves, covered with the white webs and strong threads of the caterpillars. Even in the midst of London, in the densest, smokiest, dingiest part of Bermondsey, I have seen this Moth in full force. It was simply master of the situation. The little square yard which did duty for a garden was overrun with the caterpillars, which stretched their tough silken cables across the yard, across the windows, across the doorways, across the path, and, in fact, seemed to have calculated how they could most annoy the legitimate proprietors of the place.

Not content with taking possession of the tiny garden, they invaded the houses around, and every window that was opened

was at once stormed by the caterpillars, which entered the rooms, crawled over the furniture, trailed their silken lines over everything in the room, and really made the inhabitants of the houses quite afraid to admit the little air that ever stirs in such localities. Yet, in the midst of all the smoke, the dust, the 'blacks,' and the other adjuncts of the neighbourhood, the little Moths fluttered about with wings as purely white as if they had never come within twenty miles of a chimney.

WE must not pass over without notice the lovely Long-horn Moths, of which we have several examples in England. These Moths are remarkable for the extreme length and delicacy of their antennæ, these appendages being very much longer in the males than in the females. The best known of these is the DE GEEREAN (*Adela de Geerella*). This is a truly magnificent insect. Even to the naked eye its upper wings are singularly beautiful, but when it is examined by the microscope its splendour absolutely baffles description. Suffice it to say that the wings then appear to be covered with scale armour of burnished gold, every scale taking a rich purple hue in certain lights. As the insect is turned under the microscope the edges are deeply purple, this hue being strongest and most conspicuous towards the tips. The fringe of the wings has also a tendency to purple.

The antennæ of this Moth are of enormous length. Just at the base they are rather thick, and have a very slight feathering. They then suddenly diminish, and are so long and so delicate that they almost look like the threads of a spider's web that have been casually attached to the creature's head. Indeed, I have often taken the Moth by watching for the flash of light reflected from the antennæ as they wave about in the air like threads of gossamer, while the insect is sitting quietly on a leaf.

The caterpillar of this Longhorn Moth feeds on the Wood Anemone, and is pale yellow with a black head. The structure of the chrysalis is very remarkable, on account of the manner in which the antennæ are disposed. In the pupa of ordinary Lepidoptera the antennæ lie straight down the front of the body, but such a provision would be quite insufficient for the Long-horn, whose antennæ are many times as long as the body.

On examining one of the pupæ, it will be found that the antennæ are led down the body as usual, but are then rolled spirally round the end of the tail, so as to make quite a bold knob, thus disposing of their enormous length in a very small compass.

There is another common and most beautiful species, the GREEN LONGHORN, in which the upper wings are glittering golden-green, instead of gold-brown and purple. The colour of the wings much resembles that of the young oak-leaf, on which the Moth loves to sit, and, were it not for the gleam of the waving antennæ, it might readily escape observation. Both these species are common in oak copses, and are often taken in the sweep net when the collector is searching for beetles. Six species of Long-horn Moths are known to inhabit England, the two which have been mentioned being the most conspicuous.

As an example of the leaf-rolling Tineæ, we will take that very well-known species which infests the lilac, and is known by the popular name of the CONFLUENT BARRED MOTH (*Gracillaria syringella*). It is a pretty little insect, the upper wings being ochreous and mottled profusely with dark brown, while near the tip of the wing there is an eye-like mark with a black centre. The lower wings are greyish-brown. In consequence of its food it is sometimes called the Lilac Moth.

The caterpillar of this insect undergoes two distinct stages of larval life, and is at one time a burrower and at another a leaf-roller. Almost as soon as the egg is hatched, the little caterpillar, which is then scarcely recognisable without a magnifying-glass, eats its way into the interior of a leaf, and there remains for some time, feeding on the parenchyma, or soft substance between the upper and under sides of the leaf. Before very long it grows too large for this habitation, and then makes its way into the open air, where it immediately sets about preparing a more suitable home. The mode in which it does so is very curious.

Selecting a rather young and tender leaf, the tiny caterpillar attaches a number of silken threads to the edges and tip, and fastens the other ends of the threads to the middle of the leaf, fixing them in a row, so that they look something like the warp threads in a loom. These threads, slight as they may be, are

both strong and elastic, and by their elasticity the tip of the leaf is partially curled over. The caterpillar then pulls at the threads, tightens those that are in the least loose, and so proceeds until the leaf will bend no more. It then goes back to the tip, which is now bent over, fastens another row of threads about the eighth of an inch beyond the first set, and fixes them in the same manner as before. The leaf being now much more bent, the first threads hang loosely, and are again shortened, tightened, and fastened down. In this way the caterpillar proceeds until it makes the leaf into a hollow roll, in which it may live. When one of these leaf-rolls is newly finished, the extreme elasticity of the threads can easily be tested, for the roll can be partly opened, when the threads will allow themselves to be considerably stretched, and as soon as the force is removed will spring back again to their former length. Row after row of these threads may be seen, all set in regular order, and looking almost like strips of the finest white silk.

On Woodcut LX. Fig. 2 is shown a magnified portrait of a most beautiful little Moth named *Coleophora ibipennella*. This insect, though apparently larger than those on Plate XVII. Fig. 7, is really much about the same size, the long fringes of the wings making them look larger than they really are. As the reader may see by reference to the illustration, the actual wings are very small, very narrow, and very pointed, their apparent width being entirely due to the fringe. The colour of the upper wings is satiny-white, the few nervures are slightly yellow, and there is a tendency to brown towards the tips. The under surface of these wings is grey, with a tinge of reddish-brown. The under wings are dark grey. The head and thorax are white, and the abdomen is grey with a white tuft at the end of the tail.

The scientific name of this little Moth has already been given. Hitherto it has not been recognised by any popular name, so I will call it the FLAKELET, in allusion to its resemblance to a little snow-flake.

The caterpillar is a pretty little creature. Its body is a sort of dull amber-yellow, and its head is black. The second segment has a large double black mark on the back, the third

segment has four black spots, and the last segment has one similar spot. A figure of the caterpillar is given on Woodcut LX. Fig. c. Like many of the *Tineæ* larvæ, it does not live in the open air, but makes for itself a kind of case, shaped very much like a pistol. This case is very dark brown, sometimes black, and stands on its end, the muzzle on the leaf and the but in the air. The caterpillar only protrudes its head from the case, and when alarmed it shrinks entirely within its home, and draws the opening closely against the surface of the leaf. It feeds mostly on the birch, and is quite common in most parts of England. The generic name *Coleophora* is formed from two Greek words, signifying Sheath-bearer, and alludes to the habit of living within a portable case or sheath.

THERE is, for example, the *Coleophora palliatella*, a Moth much resembling the preceding species, but larger, its spread of wings being nearly half an inch.

This larva makes a case very much resembling a paper bag tied so as to form a sort of narrow neck and a large irregular bulb. I have bred many of these Moths, and have been extremely interested in the structure of their movable dwelling. To the unassisted eye, it looks merely like a rather irregular piece of blackish membrane, but when the magnifying glass is brought to bear on it, a very remarkable structure is disclosed. If it be examined by means of an ordinary lens, it looks as if made of a vast number of small black scallop shells fastened together at their edges.

If a portion of this case be removed, and placed under a tolerably powerful microscope, the real formation of the case is revealed. It is made entirely of silk, each scallop being formed separately, and joined to its neighbours. In some cases the junctions have given way, and the scallops have become partially separated. I have seen a knitted counterpane formed on exactly the same principle technically called the 'shell-pattern,' the scallops having been knitted separately, and then sewn together at their edges. It is quite easy to trace the dates of these little scallops, for those of oldest date are dark and discoloured, while those that are last made are pure white.

On opening this case with a pair of very fine scissors, a second case is found within it, firmly attached to the outer

case by its base, the mouths of the two cases coinciding with each other, and consequently being very thick and strong. This inner case is not the least like the outer one, being nearly cylindrical, and hardly wider than the neck, except at the base, where it slightly widens. Owing to the residence of the caterpillar within it, the colour of the inner case is much darker than that of the outer. It is formed in the same manner, being constructed of a great number of silken scallops.

When the larva is full-fed, it draws the mouth of this double case tightly against the surface of the leaf, and fastens it down with a great number of silken bands, always attaching it to some nervure, generally the middle nervure, of the leaf. Within this double fortress the larva changes to a pupa, and not until it assumes the perfect shape does it leave the silken case in which it passed its larval existence.

Such is a brief description of this very remarkable habitation. I have always found them on the oak, fixed to the upper surface of the leaf, and have taken as many as I wanted in a small path running over Shooter's Hill, in Kent, where the quantity of oak underwood brings all oak-loving insects easily to hand.

As to the other members of this genus, they all make cases more or less curious, but all constructed of the same materials and for the same purpose. That of *Coleophora therinella* is very long and slender, quite straight, and of a pale-brown. That of *Coleophora currucipennella* is shaped something like a round-headed Fiji club, the neck being very narrow, and the base very large and covered with all sorts of irregular projections. The popular name of this Moth is the LITTLE WAGGONER, and its colouring is very much like that of the preceding species, except that the nervures are yellow towards the base and become brown towards the tips of the wings. The larva is rather a general feeder, and has been found upon the leaves of the oak, the saw, the hornbeam, and other trees. The larva-case of *Coleophora conspicuella* well deserves the name, for it is extraordinarily black, and looks very much like a black pea-pod in miniature, stuck by one end to a leaf.

ON Woodcut LX. Fig. 3 is shown the RED FEATHER (*Tischeria complanella*), so called from its colour and the feathery

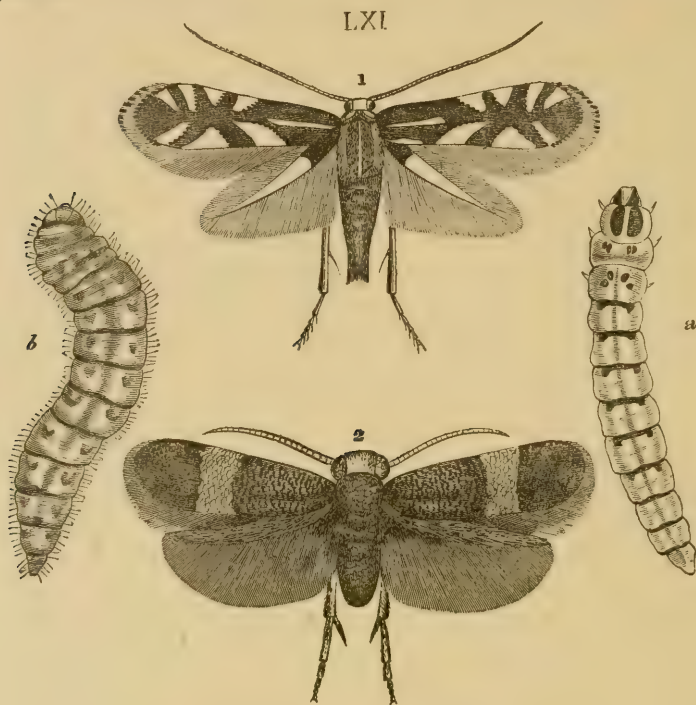
character of its wings, the upper pair being warm orange with a longitudinal black bar, as seen in the illustration. This is another of the oak-feeders, and the perfect insect is common everywhere during the earlier part of the summer. The name Red Feather is almost a literal translation of Stephen's name of *rufipennella*, which he gave to it, but which could not be retained because the name *complanella* was of earlier date. The larva of this insect is shown at Fig. d.

THE next group of Tineæ are all leaf-miners in the larval state. The name of this group is the Lithocolletidæ. The object of this name I really cannot determine. It is derived from two Greek words, the former signifying a stone, and the latter to glue or cement. Taken collectively, the words may either signify a stone-cementer, or something that is inlaid or cemented with stone. Perhaps the colouring of the wings may have given some notion of a mosaic wall, which is made of small cubes of stone cemented together.

A FIGURE of one of the prettiest of these very pretty insects is given on Woodcut LXI. Fig. 1, very much magnified. The scientific name of this insect is *Lithocolletes corylella*. No popular name has been given to it, so I shall call it the BROWN DOLLY, because the brown markings on the white wings bear, when viewed from base to tip, a certain resemblance to a rude wooden doll. It is really a very pretty insect. Viewed with the naked eye, it is so small that the shape of the markings is wholly invisible, and all that can be seen is a white surface profusely sprinkled with brown, or a brown surface spotted with white. But, when the magnifying glass is brought to bear upon it, the markings are seen to be very clearly defined. I have examined a considerable number of these beautiful little Moths, and in none of them was there any noticeable variation.

Although but few colours are employed in the decoration of the little Moth's plumage, it is a most beautiful insect, the rich brown and pure creamy white being contrasted in a wonderfully bold manner. There is a slight difference in the colour of the sexes, the upper wings of the male being soft creamy-white, while those of the female are cold grey-white.

Upon their surface are drawn the rich brown markings shown in the illustration. The fringe is whitish-grey. The under wings are grey, fringed with a much lighter hue, and darkening at the base. The sides of the head are yellow, and the face snowy-white; the thorax is of the same colour as the upper wings, and the abdomen is grey, ended with a tuft of very pale yellow.

1. *Lithocolletes corylella*.a. *Lithocolletes*, larva.2. *Nepticula aurella*.d. *Nepticula*, larva.

The larva is represented at Fig. a, very much magnified. When living it is about as long as the capital letter I, and indeed, could not be much larger in consequence of the character of its home. Its colour is pale yellow, with a blackish-brown head, and a patch of deep orange upon the ninth segment. It burrows into the leaves of the hazel (*Corylus avellana*), from which it obtains its specific name *corylella*.

This little creature is common upon its food-plant, and can easily be obtained by rearing it from the larval state. I find that nearly all leaf-miners are easily reared. They require very little trouble, and the collector is free from the ever-constant labour of procuring food, which is a serious tax on anyone who cannot pay a substitute to do it for him. But, with leaf-miners, there is scarcely any trouble at all, and the following directions will be found amply sufficient. Cut off the twig on which grows the mined leaf, and bring it home. In order to ascertain whether the larva is still inside the leaf, hold it up to the light, when a short, opaque line will at once detect its presence. Tie a piece of fine gauze loosely over the leaves, put the stem in water and all is done. These little creatures go through their transformations very quickly, and in a comparatively short time the beautiful little Moths may be seen fluttering within their gauzy prison.

The gauze bag, with its living burden, is then slipped into the laurel-bottle, and the Moths can then be set.

It is very easy to say that such Moths must be set, but to set them is a very different business. They are so very small that to get even the slenderest of pins through the thorax is quite out of the question, and they must therefore be mounted on card. It is best done by taking some very white card-board, moistening the surface with transparent cement, laying the Moths upon it, and drawing their wings into position with a very fine needle-point. As soon as the cement is dry, the card-board can be cut up into strips, so as to have the Moth at one end of the strip and the pin at the other, just as is done with small beetles. I have seen a number of these Microlepidoptera thus displayed on a piece no larger than a lady's visiting card, the effect of their glittering wings being absolutely gorgeous when a bright light was reflected upon them.

THE last of the Tineæ which we can mention in this work is the GOLDEN PIGMY (*Nepticula aurella*), which is shown on Woodcut LXI. Fig. 2. This is a very much magnified figure, as can be seen by comparing it with Plate XVII. Fig. 7, where it is represented of its natural size.

This very common insect affords an admirable example of the Tineæ, its small size and glittering hues being two of the

leading characteristics of the group. The upper wings are rich brown with a golden gloss and a tendency to purple beyond the middle. Across the middle runs a broad diagonal band of shining gold, which, under the microscope, is absolutely painful to the eyes from its splendour.

Indeed, were this minute insect only as large as our common peacock butterfly, it would be acknowledged to be the most magnificent insect in the world, and even the most gorgeous inhabitants of the tropics would pale before its splendour. Fortunately, the entomologist is independent of such considerations as mere size, for the microscope enables him to enlarge the smallest insect to any dimensions that he wishes, so that he can give to the smallest of insects all the pictorial effects which they would have if they were many thousand times their real size.

The larva of the Golden Pigmy is shown at Fig. *b*. This caterpillar burrows in the leaf of the common bramble, and in many cases is the cause of the devious tracks which are seen in its leaves. The particular path taken by these larvæ seems to be very much a matter of choice. When very young, they seem to be deterred by the presence of a nervure, and to change the direction of their track when they come across it, whereas, when they become older and stronger, they mine their way through the nervures with perfect indifference. Sometimes a Pigmy caterpillar happens to make its way, when very young, to the extreme edge of the leaf. When it does so, it seems never to be able to extricate itself from the margin, but follows with the utmost fidelity the notched edges of the leaf, sometimes nearly travelling round the leaf before it ceases to feed. When it is full-fed, it makes a very little cocoon at the end of its devious tunnel, and in a short time emerges in the perfect state.

There is scarcely a plant the leaf of which is not mined by some species of this lovely genus, so that to obtain a tolerably good series of the *Nepticulæ*, or *Pigmies*, as they are popularly termed, is not a difficult matter. This, indeed, is almost the only mode of obtaining these Lilliputian Moths—the humming-birds of the *Lepidoptera*—in any number, for, in spite of their extremely brilliant colours, it is very difficult to detect them when at liberty. They have a habit of settling on the rough

trunks of trees, old palings, and similar localities, and placing themselves so that the brown hue of their wings corresponds with that of the object on which they have settled, while the light does not reflect the glittering metallic hues with which nearly all the species are decorated. Rearing them, however, is, as has already been mentioned, extremely easy, and the only difficulty is to set them neatly without damaging their gorgeous plumage.

One of these Pigmies, *Nepticula plagicolella*, is supposed to be the very smallest of British Lepidoptera. It is a most lovely little being, the wings being deep brown with a violet gloss, across which is drawn a glittering band of burnished silver. Another, *Nepticula argentipedella*, has the upper wings of a velvet black shot with violet, and a central band of pure white. Then, *Nepticula acetosella*, has the upper wings dark shining bronze, crossed with a band of rich violet edged with a line of pure white. Much has been done with these lovely little insects of later years, but much more remains to be done, and if any of my readers will take up this one subject of the leaf-miners, they will find themselves amply rewarded for their trouble.

WE are now among some very curious and withal beautiful insects, though none of them possess the magnificent colouring which distinguishes the lovely little Moths which have just been described. They are scientifically known by the name of PTEROPHORI, or Feather-Bearers, and bear the popular name of Plume Moths, on account of the structure of the wings. In those Lepidoptera which we have hitherto examined, the wings are formed of a thin membrane stretched between certain strengthening nervures, or wing-rays, the principal of which radiate from the base of the wing. But in the Plume Moths there is no membrane, each nervure being furnished with long, hair-like plumes by which the insect is sustained in the air. In the under wings, the nervures are separate nearly from the base to the tip, but the upper wings are only divided from the middle.

There are, however, exceptions to most rules, and such is the case with the Plume Moths, for there is one Plume Moth

called *Adactyla*, or *Agdistes Bennetii*, which has scarcely the least appearance of belonging to this group of Moths, the wings not being divided at all. The popular name of this Moth is the PLUMELESS PLUME. It is found on our coasts, the caterpillar feeding upon sea-loving plants, such as the Lavender Thrift (*Statice limonium*). Both pairs of wings of this insect are very long, slender, and sharply pointed. The upper pair are yellowish-brown with a few small black spots, and the under pair simply pale brown.

THE commonest and one of the prettiest of the Plume Moths is shown on Plate XVII. Fig. 5. It is popularly known as the LARGE WHITE PLUME, the SKELETON, or the PHANTOM, all names being perfectly appropriate. Its scientific name is *Pterophorus pentadactylus*.

This very beautiful though simply coloured insect has the wings pure snowy-white, and divided into separate plumes, as shown in the illustration. In all cases the feathering of the plumes is much wider on the inner than the outer side of the nervure, very much like the structure of an ordinary bird's feather. If the wings be examined with the microscope, it will be seen that the long fringes which form the feathering are composed of the ordinary scales which cover the wings of the Lepidoptera, such scale being drawn out to a great length. Indeed, length of scale is one of the leading characteristics of these Moths, and the scales which clothe the base of the wings are also remarkable for their length. When viewed by a side light, these plumes have a satiny lustre, which quite disappears when they are viewed through a magnifying-glass, so as to render each of the delicate filaments visible.

THE Moth conceals itself during the day, making its appearance at dusk, when it flutters about like a snow-flake driven at random by the wind. It never makes a long flight, but if disturbed in one spot, just flits a yard or two and again settles on some leaf, where its white, outstretched, though not outspread wings render it very conspicuous when at rest. It never folds its wings to its body as do so many Moths, but remains with them stretched on either side to their very fullest extent, as if actually courting observation.

THERE are nearly thirty species of this genus known to inhabit England, the handsomest of which is certainly the ROSE PLUME (*Pterophorus rhododactylus*). This is really a very lovely insect. It is only partially plumed, the upper wings being without any divisions, and only the lower pair feathered. The whole of both wings is rosy pink, except the basal half of the upper wings, which are golden yellow, white, and the darkest possible chestnut brown.

The plainest and simplest of all these Moths is probably the STONE PLUME (*Pterophorus pterodactylus*), which is drawn on Plate XVII. Fig. 6. This insect is simply brown, and the darkest of all the species. The upper wings are without plumes. The habits of all the species are very similar.

THE last of the Plume Moths, and indeed, the last Moth in our list of British Lepidoptera, is the beautiful little insect which is called various names, only one of which is in any way correct. In some places it is known by the name of the THOUSAND PLUME, in others by that of the TWENTY PLUME, and in others the MANY-CLEFT PLUME, sometimes abbreviated into MANY PLUME. This last name is the only one which is correct in any way, and, after all, its correctness is only owing to its vagueness, which is almost a literal translation of its scientific name, *Alucita polydactyla*, or the Many-fingered Moth. In real fact the Moth has twenty-four plumes, which radiate from the body, so that, when the insect is at rest, its outline is almost semicircular.

It is but a little insect, the largest specimen measuring barely half an inch across the outspread wings. In its habits it is quite different to the Plume Moths. They are always to be found in the open air, whereas the Many-Plume Moth is almost invariably taken in outhouses or similar buildings. I have frequently found it on the windows of my own rooms, its peculiar shape immediately betraying it. It can easily be taken by the plan called 'pill-boxing,' i.e. putting an empty pill-box over the Moth, slipping a piece of card or paper under it, and then putting on the lid of the box as the card is withdrawn. The box can then be put into the laurel bottle, or into a vessel in which a few drops of chloroform have been placed, and in a few minutes a perfect specimen will be at the collector's disposal.

The colour of this little Moth is very pale brown, speckled with grey and dark brown, and taking an ochreous tint towards the base of the wings.

The larva of this Moth feeds on the buds of the honeysuckle, and is very common. About the end of July or the beginning of August the caterpillar is full-fed, and then spins for itself a cocoon, in which it undergoes its changes. This, I believe, is the only Plume Moth that makes a cocoon. In three or four weeks from the time of its change into the pupal state it is fully developed, and then makes its way to the nearest place of concealment, in which it may remain dormant throughout the winter.

In those places where the honeysuckle grows wild, and man has no habitation within a reasonable distance, the Many-Plume Moth is obliged to put up with hollow tree-trunks and similar localities. But barns, sheds, and outhouses generally are much more convenient places of refuge, and in them the Many-Plume remains, never moving, unless disturbed, from the spot in which it settled. It is quite curious to see the same spot occupied for months together by the same insect. This little creature must have a wonderful power of resisting cold, for I have seen it flattened against the wall in an old shed throughout the severest winter, and even though the temperature must several times have been but little above zero, the Moth seemed nothing the worse for it, but came out in the following spring, the warmth having completely restored it to animation.

HOMOPTERA.

HOMOPTERA.

WE have now arrived at a new order of insects, the HOMOPTERA. This order includes a number of insects that are apparently dissimilar, but which can, on careful examination, be recognised as belonging to the same group. Our first business is to understand the name of Homoptera.

This name is formed from two Greek words, signifying Same-winged, and is given to the insect because both the upper and under pairs are of a similar character. Both pairs are membranous, the upper pair are longer than the lower, and they do not lap over each other in repose. The body is always convex, which partly accounts for the disposition of the wings, the antennæ are usually short, and the feet have not more than three joints. The mouth is set rather back on the under surface of the head, and is furnished with a proboscis formed from the mandibles and maxillæ, which are very slender and elongated, and enclosed in the labium, which is formed into a sort of canal. The pupa is active, and bears some resemblance to the perfect insect.

In this order are comprised several well-known insects, such as the 'cuckoo-spit,' the aphis or green blight, and the scale insects, besides the comparatively rare Cicada. All these insects are very unlike each other, but they agree in the character of the wings, the form and position of the proboscis, and the mode of transformation.

It has already been mentioned that the Homoptera never have more than three joints in their feet. Mr. Westwood considers the number of joints in the tarsi as a matter of such importance that he bases his arrangement upon it, and divides the Homoptera into three groups, those which have three joints

in the tarsi, those which have two joints, and those which only have one joint. We will begin with the first of these groups, the Trimera, as they are called. All these insects have very small antennæ, at the end of which is a slight bristle. The females possess a complicated and beautiful ovipositor, with which they bore into the stems of the plants in which they deposit their eggs. The structure of these borers should be compared with that of the boring Hymenoptera, which have already been described. Three families are contained in this group, only two of which find representatives in England.

THE first of these families is called the Cicadidæ, of which only a single British species is known to exist. This insect is too rare to have any popular name, and is called *Cicada anglica*. A coloured representation of this interesting insect is given on the frontispiece, being shown in the act of flying. The colouring and appearance of this insect are so well given in the illustration that there is no need for further description on that head. In all the Cicadidæ the head is short, broad, and transverse, with three ocelli set in a triangle on the back of the head, and two very large and prominent compound eyes. The beak is three-jointed.

This is a rare insect, but is occasionally found in various parts of the kingdom, never, I believe, extending its journeys towards the northern counties. The New Forest is one of the localities where it is most frequently found. In 'The Entomologist's Monthly Magazine,' vol. i. page 171, is an account by Mr. C. G. Barrett of the capture of a female *Cicada* in Surrey. The insect was 'flying in the sunshine down a grassy side, and pitched rather suddenly among some rushes and long grass which were growing in a wide open space at a bend of the path, where I managed to secure it. Its strong membranous wings made a rustling sound similar to that produced by dragon-flies, but, being a female, it of course made no other noise whatever. I am pretty certain that I saw another specimen a few days afterwards, flying by the same spot (one of the warmest and most sheltered nooks in the neighbourhood), but its flight was so rapid that there was no chance of capturing it.'

The males are usually taken by being beaten out of the white thorn, while the females haunt the common bracken fern,

on the roots of which it is supposed that the larva feeds. The peculiar sound of its wings has already been noticed, and an allusion made to sounds produced in some other manner. In most of the Cicadæ, the males are able to produce a very loud, shrill, and monotonous sound, which in some species is so loud that it can be heard at the distance of a mile. This sound is produced by means of a remarkable internal apparatus, consisting of a pair of tightly stretched membranes or 'drums,' which are acted upon by powerful muscles. This apparatus is guarded from harm by two large plates formed from the sides of the metasternum. If these plates be lifted up, the drums can be plainly seen below them, the space between the drums and the plates being so large as to form a cavity, which evidently serves as a sounding-board.

Whether our British species sings or not appears to be a still mooted question which could easily be settled. It is true that a male kept in captivity for two or three days made no sound, and on the strength of this very negative evidence, the English Cicada was set down as dumb. Now, I have at this moment a male of the Great Green Grasshopper under a glass shade. He was perfectly silent for some time after he was placed in confinement, but is now so musical that he becomes almost a nuisance, his loud, shrill cry being plainly heard from the room below that in which I am sitting. His musical propensities are the more remarkable as he kicked off one of his hind legs while being transferred from a little tumbler to the large glass shade. Had this insect been as rare as the Cicada, and had it lived for some two days in captivity and then died, it might have been pronounced to be dumb with quite as good reason.

The females—fortunately for the ears of mankind—do not possess the shrilling apparatus, but they are provided with an instrument which is in its way quite as wonderful. This is the boring instrument or ovipositor. The principle of these borers is something like that of the corresponding instrument in the saw-fly; but, instead of being composed of two flat saws, the borer of the Cicada is formed of a double spear-headed instrument, the edges of the spear-head being strongly toothed. With this instrument the female Cicada bores holes in the material in which the future larva is to be produced, and lays

therein her eggs. The larva is shaped very much like the perfect insect, except that it has no wings, and the fore-legs are enormously developed, so as to fit them for digging. With these excavating limbs they sink deep burrows into the earth, some species of Cicada reaching a depth of three feet, and feeding on the roots of plants.

The pupa is almost exactly like the larva, except that the rudimentary wings appear in the form of four thick and pointed projections on the sides. When the time for the first transformation approaches, the pupa leaves the earth, crawls up some convenient plant, and there undergoes much the same process as has been related of the dragon flies under similar circumstances. The pupal skin splits completely along the middle of the thorax and across the head, and through this T-shaped aperture the perfect Cicada makes its exit from the pupal shell.

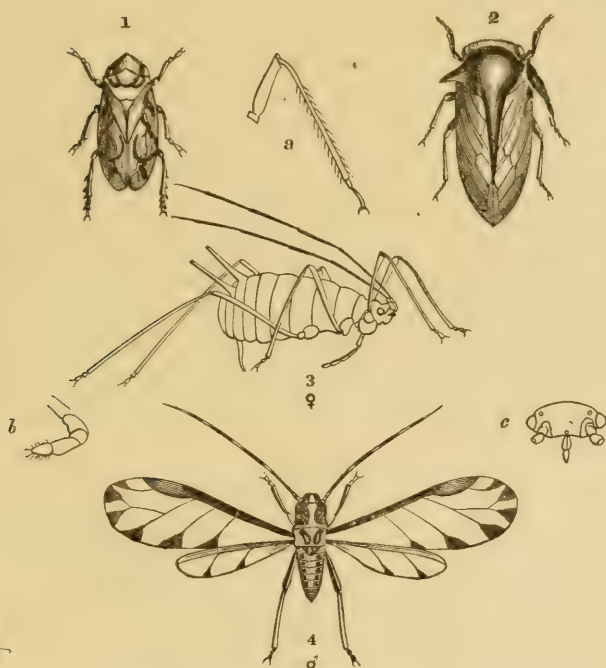
The empty pupal skin is then left clinging as it stood, and, as the natural elasticity of the skin causes the aperture to close, the empty skin is apparently unchanged in external appearance, its translucency alone betraying that there is nothing but air inside it. Even the very covering of the eyes is thrown off, and I find that although the hexagonal facets of the compound eye are plain enough when viewed through an ordinary pocket-magnifier, no trace of them is to be seen upon the cast pupal skin. Indeed, in this shed skin the horny covering of the eyes looks wonderfully like the similar part of the cast skin of a serpent. The great Cicadæ of Surinam, which can be obtained for a few pence at any naturalist's shop, are admirable assistants to the student, as their great size enables him to handle them easily, and there is a wonderful difference between the dissection of an insect a quarter of an inch in length and one that measures from two to three inches.

PASSING by the Fulgoridæ, or Lantern-flies, of which we have no British examples, we come to the third family, the Cercopidæ, which are plentifully represented in this country, and, indeed, are much too plentifully represented according to the ideas of gardeners. In this family the antennæ have only three joints, the last joint being elongated into a slender, bristle-like filament. There are only two ocelli, which are set either

on the forehead or the face, and the legs are fitted for leaping. The males do not possess any sound-producing apparatus. They are familiarly known in their perfect state by the popular name of Hoppers, and in their larval state by that of Cuckoo-spit, or Frog-spit.

The name *Cercopis* is Greek, and was used by the ancient writers on natural history to denote some kind of Cicada.

LXII



1. *Ptyelus bifasciatus*. 2. *Centrotus cornutus*. 3. *Aphis tilia*, female.
4. *Aphis tilia*, male. a. *Aphis*, leg. b. Do., labium. c. Do., head.

Our first example of this family is the EARED HOPPER (*Centrotus cornutus*), which is shown at Fig. 2 on Woodcut LXII.

This creature is remarkable, not for the brilliancy of its colouring, nor for the boldness of its marking; for it is simply dark-brown dotted with a very slight yellowish-dun, and has no markings whatever.

But the 'pronotum,' or first portion of the upper part of the thorax, is developed in the most extraordinary manner into a horn-like projection at each side, while the centre bears a long, sword-like appendage, which reaches over the whole of the body and very nearly reaches to the tip of the abdomen. The whole of the upper part of the thorax, the two appendages at the side, and the sword-shaped horn, are covered with tubercles, which give the surface a glittering aspect when the light shines on it. A magnifying-glass is necessary in order to detect these tubercles. The only colour in the upper wings is restricted to the base, where there is a little patch of circular, eye-like spots, each having a solid black centre, then a white ring and then a narrow black ring or outline. There is also a slight clouding of chestnut brown.

This curious insect has the upper wings shining and rather yellowish, and the under wings transparent and iridescent, with brown nervures. The thighs are rusty red, and the rest of the leg pitchy black. It is tolerably common in woods and gardens, and can be taken in the sweep-net by passing it over laurels, thistles, and the herbage of the hedge-side. It appears in May and June. The first specimen of this insect that I ever possessed was given to me in 1850 by the late Rev. F. W. Hope, with whose magnificent collection all entomologists are familiar.

ON Plate XVIII. Fig. 1 is represented an insect which is called by the name of *Ledra aurita*. I do not know that it has any popular name. Like the last-mentioned insect, it has some curious projections from the thorax, which in this case take the form of two flat projections from each side, looking somewhat like ears, whence the specific name *aurita*, or eared. The edges of these 'ears' are notched or waved. It is not a handsome insect in point of colour, its principal hue being dull olive-green, which is apt to change after death to yellowish-brown. The head is covered with a number of small reddish tubercles. As to the rest of the insect, it cannot be seen properly until the wings are spread. The upper pair are olive-green, becoming transparent towards the tip, and the nervures are brown. The under wings are pale grey-brown with dark nervures. The abdomen is very wide, flat, and covered with a



PLATE XVIII.

TERRESTRIAL HOMOPTERA AND HETEROPTERA.

- ✓ 1. *Ledra aurita*.
- ✓ 2. *Ledra aurita*, larva.
- 3. *Triepphora sanguinolenta*.
- 4. *Pentatoma dissimile*.
- 5. *Stenocephalus agilis*.

PLANTS:—

Great Ragwort (*Senecio Jacobea*). Above.

White Dead Nettle (*Lamium album*). Below.



rather horny skin. The perfect insect jumps when alarmed, but can only leap a very short distance.

The larva of this insect is shown at Fig. 2 of the same Plate. It is coloured much like the adult insect, but has no wings nor the least signs of the conspicuous 'ears' which decorate it when adult. Even when it assumes the pupal state these projections are not visible, their places being merely indicated by two raised knobs. It is not a common insect, and has been mostly taken in the New Forest by beating it out of oak. The larva feeds upon oak, and does not surround itself with the frothy secretion so familiar to us as Cuckoo-spit. One of them was discovered by the Rev. T. A. Marshall, while digging at the roots of an oak in January; this discovery proving that the insect hibernates while still in the larval state. It has been found in Purfleet in Kent.

On the same Plate, Fig. 3, is shown a very beautiful insect, which in point of colour is by far the handsomest of our British Homoptera. This is the SCARLET HOPPER (*Triepphora*—or *Cercopis*—*sanguinolenta*). It is impossible to give in the simple black and white of printer's-ink an idea of the beautiful and bold colouring of this insect.

That part which appears as white is rich scarlet, and the rest deep black, both having a velvety appearance. When one of these beautiful wings is placed under the microscope, the cause of the rich velvety look is at once shown. The surface of the wing, instead of being smooth, as it appears to the unaided eye, is covered with a vast number of minute rounded projections, very much like those on the upper surface of a geranium petal. An irregular network of fine black lines traverses the whole of the wing, and at each of the intersections there is a round black spot with a translucent centre, the whole of these markings having the effect of softening and enriching the colour in a very effective manner. Both the black and the red portions of the wing are thus adorned.

This handsome insect is very local, and in many parts of the country is never seen. It used to be very plentiful in Bagley Wood, near Oxford, and all the specimens in my collection were taken there by myself in 1847. It was always found on the fern, and was mostly captured by using the sweep-net at

random. It could often be seen sitting on the fern-leaves, but it is so active and wary that as soon as the intending captor approaches, it jumps off the leaf, falls to the ground, and is lost. Sometimes it flies to a little distance, but as a rule it does not trouble itself to use its wings, but merely leaps to the ground.

NEXT come those insects which are popularly known as CUCKOO-SPITS, because it used to be the general opinion that they were formed either from the spittle of the cuckoo or that of the frog, and in consequence they have also received the name of FROG-HOPPERS. This very absurd notion is by no means confined to this country, neither is it modern; for in the days of Aristotle the insects were said to be generated from the spittle of the cuckoo, while the French popular name of Crachat de Grenouilles shows that the notion of the frog-spit prevails on the Continent as well as in England.

ONE of these insects, scientifically termed *Ptyelus bifasciatus*, is shown on Woodcut LXII. Fig. 1.

This is a most accommodating creature as far as regards colour, for it takes almost any hue or mixture of hues between grey and black. Some specimens are almost wholly black, and some are entirely grey. Many have the upper wings black, and the thorax spotted with yellow. Generally, however, the insect is crossed with two bands of a lighter hue than its ground colour, whence the specific name of *bifasciatus*, or two-banded.

The larva of this and allied insects has a very curious mode of life. It fixes its residence on the young and tender twigs, and drives its proboscis into the bark, whence it draws the sap which constitutes its nutriment. Just as the larvæ of several insects cover their bodies with the remains of their solid food, so are the larvæ of the Frog-hopper protected by the remains of their liquid food. They eject a quantity of liquid, which is formed into bubbles, and takes the form of a frothy substance, in which the body of the larva is entirely concealed. As every one knows, bubbles have a proverbially short existence, and these bubbles break in succession, allowing a drop of clear transparent fluid to collect at the bottom of the froth-mass. When this drop becomes too large to be upheld it falls to the

ground, and another takes its place. If the froth be put aside the larva will be discovered in its midst—a little, soft, white creature, with tiny black eyes that form a curious contrast to the general white hue of the body.

In the perfect state all these insects jump with great agility, and in this movement their hind legs are almost exclusively employed. The commonest of all the species, *Aphrophora spumaria*, or the COMMON FROG-HOPPER, can jump to a wonderful distance, even unaided by its wings. Indeed, the ordinary leap of the Frog-hopper is about equal to that of a man who could jump four hundred yards without even taking a run. In making this astonishing leap, the insect is aided by some sharp spikes or spines upon the ends of the tibiæ, which enable the limb to take a firm hold of the ground.

Perhaps the actual damage done by the Frog-hopper is not so great as is imagined. A tree contains a vast amount of sap, and none of our British Homoptera possess the wonderful distilling power of a Madagascar species (*Aphrophora Goudotii*), which has been found capable of pouring out a considerable amount of clear and apparently pure water in the very middle of the day, the sap appearing simply to run through the insect as through a tube. The generic name, *Aphrophora*, which has been given to this and many allied insects, is formed from two Greek words, literally signifying ‘foam-bearing.’

To the unassisted eye, the common Frog-hopper is about as inconspicuous and commonplace an insect as can be found anywhere. The magnifying-glass, however, alters the whole aspect of the creature, and an ordinary pocket-lens will show that the upper wings are covered with tiny projections, giving them an appearance very much like that of shagreen.

If, however, one of these upper wings, or elytra, if they may be so called, be detached from the insect, and viewed through a moderately powerful microscope—an ordinary half-inch object-glass being employed—the simple, uninteresting object starts into sudden beauty. The groundwork of the wing is seen to be composed of a membranous network, much like that of the wings of the dragon-fly, and upon it are innumerable round eye-like spots, arranged in irregular transverse rows. These spots are of uniform size, and consist of a dark centre surrounded by a white transparent line, each spot being separated

from its neighbour by a space about equalling its own diameter. These spots are, in fact, the little tubercles whose existence is described as being detected by the pocket-lens.

Many species of Frog-hopper inhabit England, but the two which have been selected will serve as excellent examples.

THE next group of this remarkable order is that which is named Dimera, or two-jointed, because the tarsus has only two joints. The antennæ are always slender and longer than the head, and the winged individuals possess four wings, both pairs being of much the same texture. We will pass at once to the important family of Aphidæ, or Plant-lice, sometimes known under the popular name of Green Blight.

One of the commonest of these most remarkable insects, the LIME-BLIGHT (*Aphis tilia*), is shown on Woodcut LXII. Figs. 3 and 4, the upper figure representing the female, and the lower the male.

The colour of the male is dull yellow, with a double row of black dots down the back. In the wings the stigma, or spot, is yellow, and all the nervures are yellowish-brown at the tips. The female is simply yellow. Fig. *b* represents its rostrum, or beak, and Fig. *c* the front of the head, all these figures being much magnified. The insect can be taken with the sweep-net in long grass, which the male loves to frequent, while the female is found on the lime-tree.

Insignificant as may be a single *Aphis*, these insects are most formidable from their numbers, as all gardeners know to their cost. Roses are often so thickly covered with these pestilential insects that the leaves and buds are completely hidden, the latter never being permitted to develop themselves into flowers. Indeed, there is scarcely a plant that has not its *Aphis*, and these extraordinary beings not only haunt the leaves and the twigs of plants, but the roots and the fruit. Mr. Newman remarks in his 'Letters of Rusticus': 'Plant-lice are everywhere. I have to-day (August 15, 1835) cut open codlin after codlin, and found the pips garrisoned with them; not one lone *Aphis*, but a whole troop of all sizes. When I let in the daylight there was a considerable sprawling and waving of legs, and no small alarm in the hive, but by degrees they got used to light and fresh air, and were quite still. I tried to tickle them

with a straw in order again to watch their movements, when, lo and behold, they were all dead—gathered to their fathers—gone to the tomb of all the Capulets! Some had heaved anchor, and dropped from the pip; others, fixed more firmly, had died at their posts, and, tucking their legs together under them, hung by their beaks.

‘In no apple was there any road in or out. There was no chance of their passing to the exterior air, or of their having come from it; indeed, their speedy death showed that change of air did not agree with them. I was particularly careful in my search for a *via*, but there was none. I have often seen the same thing in a bloated poplar-leaf; but here is a possibility of the egg being laid between the cuticles of the leaf; thus, the sap-suction commencing, the bloat may be caused, but this is impossible in a huge apple with an inch and a half of pulp in every direction. I am unable to explain the mystery; and, like many other wiseacres, content myself with wondering how, in the name of fortune, the Aphides got there.’

These insects are prolific almost beyond belief. As a general rule, insects lay eggs which are hatched, pass through the state of larva and pupa, and then become perfect insects. But the Plant-lice go on a very different plan. Sometimes, as if to show that they are amenable to law, they do lay eggs; but this is the exception and not the rule, which is somewhat as follows, though varied every now and then by these most eccentric of insects.

A female Aphis takes her place on a branch—say of the rose—plunges her beak into the tender bark and begins to suck the sap. After a short time she begins to produce young Aphides, at an average rate of fourteen per diem. These young creatures are just like their mother, only less, and immediately follow her example by first sucking the sap of the plant and then producing fresh young. As to the opposite sex, it is no business of theirs, and I have often wondered that the Shakers have not adduced the Aphides in support of their peculiar tenets. The extent to which this peculiar mode of increase can be carried may be imagined from the fact that a single female Aphis, isolated from the other sex, began to produce prolific females, which in their turn produced others, and so on for four years; during the whole of

which time not a male *Aphis* had been suffered even to approach them.

It is in consequence of this remarkable mode of production that the twigs and buds become so rapidly covered with *Aphides*, the quickly-succeeding generations crawling over the backs of their predecessors, so as to arrive at an unoccupied spot of bark in which they can drive their beaks. Thus, at the beginning of a week, say on Monday, a rose-tree may be apparently free from *Aphides*, or have at the most six or seven of the 'blight' upon it. But, by Thursday, the whole plant will be so thickly covered with *Aphides* that scarcely a particle of the bark can be seen, the whole being crowded with the green bodies of the insect, each with its beak dug deeply into the plant, and draining it of its juices. It is difficult to prescribe any mode of getting rid of these garden pests. The double-brush answers as well as anything I know that can be applied by the hand of man; but there is nothing so effective as the natural foes of the *Aphides*, namely the Lady-birds, whose mode of feeding has already been described, and the *Syrphi* or Hawk-flies.

If the reader will refer to the illustration on Woodcut LXII., he will see that from the back of the *Aphis* and towards the tail there are two slender projections. These are tubes, from which exudes a sweet liquid; which, with the aid of the microscope, can be seen starting in minute drops from the end of each tube. When the *Aphides* are in great profusion upon a tree, this liquid falls from them, and covers the leaves with the sweet, sticky substance which is so familiar to us under the name of 'honey-dew.' Trees thus distinguished are always overrun by swarms of ants, which lick the sweet droppings from the leaves and hold high revels on this substance, whose origin was once so mysterious.

The ants even go farther than this. Not content with taking the honey-dew that has fallen from the *Aphides*, they anticipate its fall, and eagerly lap up the sweet secretion as it exudes from the insects. In fact, they make much the same use of *Aphides* as we do of cows, and even carry off the ant-cows, as they may be called, to their own nests, and there keep them. That the ants do this has long been known, but the notion of keeping milch-cows seemed so far beyond the capacities of an insect that many persons refused to give credence

to so romantic a story. It is, however, perfectly true, as may be seen by the following extract from the 'Letters of Rusticus':—

'Another odd station for Aphides is on the roots of plants. I have found them by hundreds on a thistle-root, closely packed together, and almost as white as snow. The other day I pulled up a large thistle that grew on an ant-hill, and thus I brought to light a whole colony of these white Aphides. I had long known of the great value which ants set on these little beasts; so I shook down some dozen of them from the thistle-root, among the ants, which were all a-swarm at the damage I had done to their dwelling.

'No sooner were the ants aware of the presence of the Aphides, than they began to fondle them with their legs, sometimes positively taking them round the neck, to tap them on the back with their antennæ, and to lick them with their tongues; they then took hold of them with their jaws and lifted them from the ground, and carried them with the greatest care, one by one, into the recesses of the nest. I walked by the same way about three hours afterwards, and found the nest all quiet and orderly, and not an Aphis was to be seen. So I went to work with my knife and scraped down the side of the hill. I soon came to the Aphides. They were clustered together on little bits of thistle-root, which had been broken off in the ground, and were attended by numbers of ants. When the ants found their cattle were again in jeopardy, they drew them gently from the root and carried them still farther into the nest.

'I am quite convinced that honey-dew is a secretion from the Aphides, and that ants devour this honey-dew, and a sweet, clear, liquid honey it is. I have often watched an ant go from one Aphis to another, stand behind each, and gently squeeze the body with its fore-legs; perhaps one Aphis in ten, not more, will give out a small drop of honey as clear as crystal, which the ants instantly swallow. The ants take much more care of the Aphides than the Aphides do of themselves; they are sad, dull, stupid creatures. It is very pretty to see the licking and washing and cleaning and caressing which the ants constantly bestow on them. When the Aphides cast

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their skin, the ants instantly carry it away, nor will they let any dirt or rubbish remain among them or on them.

‘But the most amusing care of the ant is guarding the Aphides from the attacks of that little parasitic fly, whose operations Mr. Haliday has so well described. You must have seen a sheep-dog run over the backs of a whole flock of sheep, when closely crowded together, in order to bring back some sinner that has gone astray; so will the ants, in the hot sunshine, run about over an establishment of Aphides, driving away the rascally parasite that is for ever hovering over to destroy them.’

The reader will doubtless have noticed that some Aphides have wings and that others have none. In fact, by far the greater number of these insects are without wings, like the central figure on Woodcut LXII. In the early part of the year they are all without wings, those organs being added about the end of summer.

The effect which these insects have upon vegetation is extraordinary. As to the hop-plant, it is in a great measure dependent for its success upon the presence or absence of the Aphis, which in hop-growing districts is called THE FLY, no other winged insect being deserving of such a name. All hop-growers watch their crops with the utmost assiduity, and the presence of the Aphis, though only upon a few plants, causes consternation in the hearts of the growers. Owing to the astonishing fecundity of the insect, and the rapid manner in which plants which were perfectly free from the Aphis become absolutely covered with its green armies, an idea is prevalent that the insects are brought by certain winds; and no sooner does a chill, depressing, north or north-western wind blow for any length of time, than all the gardeners’ heads are shaking ominously, and all their tongues are muttering fears of blight.

Now, absurd as are many of their notions, such an idea as this could not have gained so universal a hold without having some element of truth in it, which element I take to be this. The Aphides form the food of very many insects. The larvæ of the Ladybirds feed entirely upon them, and so do those of the Lacewing-flies, both of which insects have already been described. They are also eaten by the larvæ of the swift and

active Syrphida, which will presently be mentioned. Several Hymenoptera provision their nests with them, and others of the parasitic kind, such as Chalcidicæ, Proctotrupidæ, Cynipidæ, and Ichneumonidæ.

As to these last insects, the mode in which they operate on the Aphis is very remarkable. As may be inferred from the size of the Aphides, on which they are parasitic, they are of very small dimensions, and one of these tiny creatures when standing on the back of an Aphis which it is about to wound, looks much like a rook perched on a sheep's back.

When the fatal egg has been introduced under the skin of the Aphis, the wounded insect, like the stricken hart, separates itself from its fellows and passes to the under side of a leaf, and there fixes itself. Its body soon begins to swell, and at last becomes quite globular and horny, the change being caused by the death of the Aphis and the rapid growth of the parasite within it. The ichneumon passes rapidly through its changes, and in a short time assumes the perfect form, always with its head next the tail of its victim, pushes off the last two or three segments of the dead Aphis and makes its escape into the world. The dead and empty skins of such hapless Aphides may be found plentifully towards the end of summer, sticking firmly to the leaf, and showing the round aperture through which the destroying parasite has crept.

Sometimes there is a sort of contest between the Aphis and the ichneumon-fly, the former, however, having no more chance against its tiny foe than has a rabbit against a weasel. If the Aphis have its beak deeply plunged into the bark, the ichneumon-fly has an easy task, for the Aphis can do nothing but kick and struggle while anchored to the spot by its proboscis, and all that the ichneumon-fly has to do is to make its deadly lunge. But, if the Aphis be wandering about the plant, the ichneumon-fly has to walk about with it, and try first one side and then the other, until she can find an opportunity of depositing her egg.

WE now come to a very remarkable group of Aphides which have been gathered together under the generic name of *Eriosoma*, or Wool-bodied, because their bodies are covered with a substance like very fine cotton wool. These insects

do not possess the honey-dew distilling apparatus, and the antennæ are shorter than in the generality of the Aphidæ. The peculiarity, however, which principally distinguishes them is the envelopment with woolly fibre, which almost entirely covers the body, and renders it so light in comparison with its size that it can be blown through the air like a small tuft of swan's down, and in this way it passes from one locality to another. The best known of these insects is that which is popularly called AMERICAN BLIGHT (*Eriosoma aphidæ*, or *Lachnus lanigera*), which sometimes overruns our orchards in a marvellously rapid manner, and sometimes destroys hundreds of apple-trees by its vast numbers.

The following graphic and amusing description of this insect, and the best mode of getting rid of it, is given in the 'Letters of Rusticus,' to which reference has already been made:—

'I don't know why our brethren on the other side the Atlantic are charged with sending us the greatest pests of our orchards, but so it is. We call an insect the American Blight, which, for aught I could ever make out, may have come from China or Botany Bay. However, a name once in vogue will have its day; and one might as well attempt to turn a pig in an entry as argue against an established belief, so American Blight it shall be. In very hot weather you may now and then see this Blight on the wing; it has just the look of a bit of cotton, or a downy seed, floating in the air, and is driven by every breath of wind quite as readily.

'If you catch and examine it, you will find it to be just like the plant-louse which infests our rose-trees, &c.; but, unlike all other plant-lice, it is clothed and muffled up with cotton-wool in such quantities, that you would at first have no more idea that the lump contained an insect than that the mass of clothes on a stage-coach box in winter contained a man. Some folks wonder what can be the use of so much clothing; I am not much of a theorist, but I should guess that the vermin came from the torrid zone, and nature kindly furnishes this garment to protect them from the cold of our climate.

'These Blights wander wherever the wind pleases to carry them; and if bad luck should drive one of them against the branch of an apple-tree, there it will stick, creep into a crack in the bark, bring forth its young, and found a colony. The

white cotton soon appears in large bunches; branch after branch becomes infected; the tree grows cankered, pines, and dies. How this is effected no one knows, though the plague and its doings are too evident to escape the notice of the commonest clown.

‘In large orchards it is in vain to hope for a cure, but not so in gardens. Directly you see the least morsel of cotton, make up your minds to a little trouble, and you will get rid of it. In the first place, get a plasterer’s whitewashing brush, then get a large pot of double size, make your man heat it till it is quite a liquid, then go with him into the garden and see that he paints over every patch of white, though not bigger than a sixpence; the next morning have the size-pot heated again, and have another hunt, and keep on doing so every morning for a fortnight. Your man will tell you it’s no use; tell him that’s your business, not his: your neighbours will laugh at you for your pains; do it before they are up. I have tried it and known it to be effectual. Spirit of tar has been used with partial effect, so also has resin; whitewashing has been often tried, and, as it contains some size, is not entirely useless, and some horticulturists think it ornamental; I do not.’

Even in the winter time the task of extermination can be carried on. When the weather becomes cold, the Aphides crawl down the trunks of the trees and hide themselves among the roots below the surface of the soil. As they cannot endure the cold, the best way of getting rid of them is to expose them to it. So, in the depth of winter, when the thermometer is at its lowest, an inch or two of soil should be scratched up around the trunks of the trees, so as to expose the roots and let the cold air upon the Aphides that are in hiding. The ground should be freshly turned up every day while the frost lasts, and, when the thaw comes, the ground should be well saturated with a solution of ammonia before the earth is replaced. The ammonia-water from the gas-works is amply sufficient for this purpose, is very cheap and easily obtained.

WE now come to the last great group of the Homoptera, namely, the Monomera, or those which have but one joint in the tarsus. These are all included in the genus *Coccus*, popularly known as Scale Insects, on account of the singular form

of the female, and MEALY-BUGS, on account of the white substance which envelopes the young Cocci. Mr. Westwood remarks that these form 'one of the most anomalous tribes of insects with which we are acquainted, and which already prove that annulose animals may exist, which become more and more imperfect as they approach the winged state, and which in that state lose all trace of articulation in the body as well as of articulated limbs (as in the female Cocci), leaving, in fact, inert and fixed masses of animal matter, motionless and apparently senseless, and which resemble nothing more nearly than the vegetable excrescences called galls.' The same eminent entomologist also points out the remarkable analogy which exists between the Coccidæ among the insects, and the Cirrhipeda, or Barnacles, among the crustacea.

It is rather difficult to find a starting-point for the history of this remarkable insect, but we will begin at the early larval condition. In this state both sexes are alike, very small, and nearly as large as the dot over the letter i; six-footed, active, and having two long and slender bristles at the end of the body. When they are large enough to shift for themselves, they proceed along the branches and fix their beaks into the bark of the twig, or the spider-veins of the leaf, and remain from that time motionless, growing rapidly in size, but losing the tail-bristles. Thus they remain throughout the winter, and not until the following spring do the sexes develop themselves; the males assuming their wings and taking to flight, and the females remaining where they were. The subsequent career of the insect has been traced by Alphonse Karr, in his 'Voyage autour de mon Jardin,' a translation of which was published by Messrs. Routledge and Co. in 1854:—

'The journey once completed, it will repose after it for the rest of its life. It will fasten itself to a young branch, and not only will it never leave it again, but, still further, it will never quit the point of the branch upon which it has established itself. It grows—that is its mission, that is its duty. When it become as large as a pea, there comes a most singular little fly, of a deep red, with two wings twice as long as its body. These wings are of an opaque white, ornamented on the outward side by a rich carmine band. These little flies are the males of the animated tubercles.

‘Among these insects may be seen that which the Romans required of woman carried to the highest degree—

Lanam fecit, domum servavit.
She spun her wool and kept her house.

While the male—small, rakish, nobly clothed in purple—flies about at hazard, the female, scarcely living, taken for a gall of the tree, for the swelling of a leaf or branch, remains motionless and waits for her husband. The male, who is singularly small in comparison, walks over her, surveys her all over, for she is for him a sufficiently large tract. He examines her from north to south and from east to west, and it is not until he is fatigued with running about over his beloved object that he risks the avowal of his flame; after which, flying once or twice round his beloved, he departs.

‘The wife from that moment thinks of nothing but the numerous family she has to bring into the world—about two thousand children. She begins to lay, and her eggs all come enveloped in a sort of cotton. *Lanam fecit.*

‘Then the Scale Insect changes its form—its belly flattens and becomes so thin that it joins the back; which forms a hollow space under it in which are its eggs. Its back hardens, the belly and the back are quite confounded; the Scale Insect withers, dies, and becomes a dwelling-place for its young ones. This is better than the *domum servavit*; she does not remain in the house, she becomes the house itself.’

In England the Scale Insects are an unmitigated nuisance, especially in greenhouses and hothouses, where they flourish in great abundance, sticking upon the leaves of various plants and sadly vexing the heart of the gardener. Yet some of the Cocci are directly beneficial to man, though those species which reside in our country have never yet been put to any use. It is to an Asiatic species of Coccus (*Coccus lacca*, or LAC INSECT) that we are indebted for our sealing-wax and the basis of many varnishes. The female insect produces the well-known material called ‘lac,’ and without her aid we should be deprived of a most useful as well as ornamental substance.

Another of these insects, *Coccus ceriferus*, produces in abundance a kind of wax, in which the body of the female is

entirely enveloped. But the most valuable of these creatures is perhaps the COCHINEAL INSECT (*Coccus cacti*) of South America, from which is obtained the most brilliant of crimson dyes. Other species of *Coccus* produce a fine scarlet colour, but none of them can be compared with the Mexican insect for the wonderful abundance and rich colour of the dye. The valuable colour called carmine is made from the Cochineal insect.

HETEROPTERA.



HETEROPTERA.

CHAPTER I.

AUROCORISA, OR AIR-BUGS.

THE reader may remember that the insects of the last order are called Homoptera because their wings are of similar character. In the new order which now comes before us, the wings are formed after a manner which has earned for them the name of Heteroptera, or Different-wings. They include a large number of familiar insects, many of them aquatic, among which may be mentioned the Water-fleas, the Water-scorpions, the Water-boatmen, and the too familiar Bed-bug.

In some of these insects the wings are not developed, but in those that are furnished with wings the upper pairs are larger than the lower, and lap over them when the insect is at rest, and the basal part of them is hard and leathery, while the remainder is membranous and translucent. The body is always flattened, and the mouth furnished with a beak, or proboscis, which starts from the under surface of the head, but from the front and not the back. The pupa is active, and resembles the perfect insect in appearance, save that it does not possess wings.

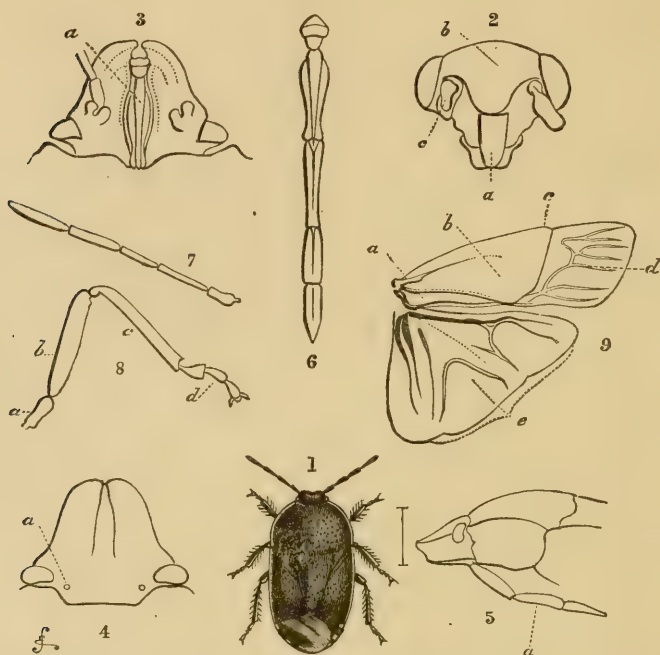
These insects are broadly divided into two great sections, the one called Hydrocorisa, or Water-bugs, and the other, Geocorisa, or Land-bugs.

We will begin with the latter of these two sections. Mr. Westwood prefers to give to the insects the name of Aurocorisa, or Air-bugs, because many of the species do not affect the land, but pass the greater part of their time on the water, though they do not dive beneath its surface.

THE first of these insects is the rather rare one which is represented in the accompanying illustration. Having already

been practised in the anatomy of other orders, the reader will not find much difficulty in mastering the details of a Heteropterous insect. The chief point lies in the beak, proboscis, or promuscis, as it is called by some writers. This instrument is either three or four-jointed, the latter being the case with the insect which is drawn in the illustration. This

LXIII



1. *Sehirus dubius*. 2. Head, front view; *a*, Central lobe of face; *b*, Crown. 3. Head, under side; *a*, Rostral channel, with the rostrum or beak in position. 4. Head, upper side; *a*, Ocellus. 5. Head, profile; *a*, Rostrum. 6. Rostrum. 7. Antenna. 8. Leg; *a*, Fulcrum; *b*, Femur or thigh; *c*, Tibia; *d*, Tarsus. 9. Elytra and wing; *a*, Clavus; *b*, Corium; *c*, Elytron; *d*, Membrane; *e*, Wing.

does not, however, constitute the whole of the apparatus, as it is only a sheath for the real piercing instrument, and is, like the mask of the dragon-fly larva, a development of the labium. If this sheath be opened under a microscope it will be found to contain four delicate sharply-pointed bristles, which, when examined by the aid of the microscope, are seen to be the jaws and maxillæ of the insect modified into this singular form. In

some of the predaceous species the end of the mandible is spear-shaped, and the outer side of each spear-head is armed with a row of extremely sharp teeth, not at all unlike those of a shark. Indeed, I have in my ethnological collection a Kingsmill Island spear, which is armed along the side with shark's teeth, and bears a singular resemblance to the mandible of a Water-boatman, an insect which will be presently described.

Unfortunately, very few of the Heteroptera possess popular names, so that I am compelled to use the scientific titles. The name of the insect which is shown on Woodcut LXIII. is *Sehirus*, or *Cydnus dubius*, and it belongs to the family Cydnidæ. It is a rather small, but decidedly handsome insect. The general hue is deep violet-blue, so deep that it seems black in a faint light, and the surface is finely punctured and shining. The edges of the thorax and the elytra are marked with a narrow line of yellow, from which circumstance it has been named *albo-marginatus*, or white-edged, by some entomologists. If the insect be turned up, the under side of the abdomen will be seen to be extremely convex.

It is not a common insect, and seems to be local. It has been taken at Portland and Pangbourne.

NEXT comes the insect which is represented on Woodcut LXIV. Fig. 1, an example of another family, the Asopidæ. Its name is *Asopus luridus*.

Although not so brilliant as the insect which has just been described, it is a pretty creature. Its colour is yellowish, thickly punctured with black and rather shining. On the head and sides of the thorax there is a deep blue gloss, which occasionally changes to bronze. Below, it is yellowish, with two distinct longitudinal rows of black spots. The female has also a large black spot on the sixth segment of the abdomen.

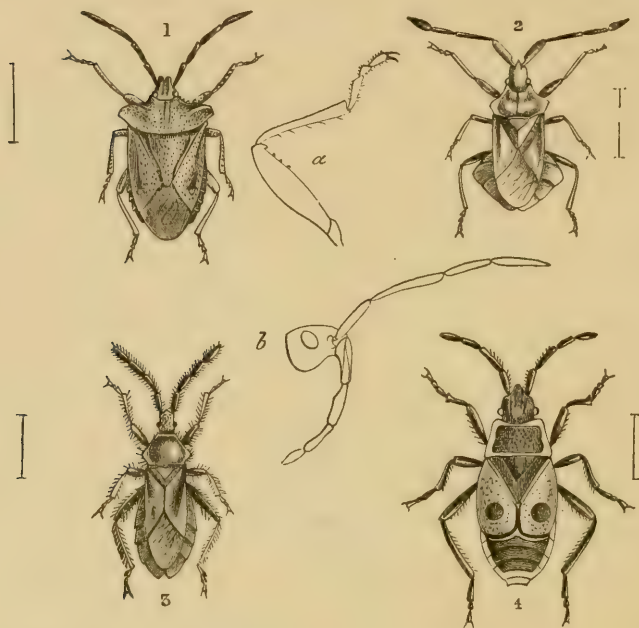
This species is not very common, but is wider spread than the preceding insect, and may be found on trees.

The whole group of insects to which this species belongs is popularly known under the name of BISHOPS, or sometimes BISHOP'S MITRES, on account of their form. They are much and justly dreaded by fruit-growers, and this for two reasons. In the first place, they greatly damage the fruit as soon as it ripens, by sucking the juice; and in the second place, many of

them possess a most abominable odour, which communicates itself to any fruit over which a Mitre insect has walked. The cherry orchards are sadly infested by these insects, but no way of destroying or even checking them has yet been found.

This odour is due to a fluid which passes out of two little pores between the hind feet, and the insect is able to eject or retain it at will. It has been observed that if a Mitre insect

LXIV



1. *Asopus luridus*. 2. *Verlusia rhombea*. 3. *Coreus hirticornis*. 4. *Pyrrhocoris apterus*. a. Do., fore-leg. b. Do., side view of head, showing antenna and tongue.

be suddenly seized, plunged into water, and held there, the two pores give out a number of tiny bubbles, which rise rapidly to the surface, burst, and then give out the disagreeable odour. Fruit is often rendered quite uneatable by being tainted with this evil-smelling substance. I believe that the insect uses the fluid as a means of defence, as is the case with many other insects and animals, and that it does not eject any of it upon a fruit except when alarmed. There are some few of these

insects in which the scent is rather agreeable than otherwise but as a general rule the odour is simply disgusting, as anyone knows who has captured and set many specimens.

ON Woodcut LXIV. are seen two examples of the family Coreidæ. This is a large family, and contains within it many of the largest and most conspicuous members of the Heteroptera. They are known by the form of the antennæ, which consist of four joints, and have the last joint either thickened or elongated. The beak is usually long. Fig. 2 represents the insect called *Verlusia rhombea*.

This species is not brilliantly coloured, the general hue being a dull yellowish-brown. The upper surface is covered with exceedingly minute punctures. The head is darker than the rest of the body, and the sides of the thorax are ochreous-yellow. It is much paler below than above, and the legs are yellow. It is common on the leaves of trees in the autumn. The specific name of *Rhombea* is given to this insect in consequence of the singular shape of the abdomen, which is flattened and widened into a rhomb-like shape, as seen in the illustration.

In common with the rest of its family, the species can both run and fly well, choosing the hottest part of the day for their flight. As is the case with the Water-boatmen, they make a loud humming sound with their wings, sometimes as loud and deep as that of the humble-bee.

At Fig. 3 on the same Woodcut is shown an insect belonging to the typical genus called *Coreus hirticornis*.

The colour of this insect is dull chocolate-brown above, and the upper surface is thickly covered with minute wrinkles, which even extend over the legs and thighs. Beneath, it is ochreous-yellow, mottled with a rather darker hue. The sides of the thorax have a narrow edge of white. The antennæ are remarkable for their hairy covering, which extends throughout their whole length, and has gained for the insect the specific name of *hirticornis*, or hairy-horn. The insect is common on thistles.

The larvæ and pupæ of insects belonging to this family are like the perfect insect in general form. The larvæ, how-

ever, possess no wings, and the pupæ only have them in an undeveloped state. Mr. Westwood mentions that he possesses some larvæ and pupæ, which also differ from the perfect insect in being without ocelli, and having only two joints in the tarsus.

ON Plate XVIII. Fig. 5, is shown another example of this family. This insect is called *Stenocephalus agilis*.

The colour of the insect is pale brown, with a tiny red spot on each shoulder. The legs and antennæ are yellow, except that each joint has a black tip. The generic name is formed from two Greek words, signifying 'short-headed,' and its specific name of *agilis* is given to it because it is remarkably active, both on foot and on the wing, and is fond of running about in the hottest sunshine.

THE curious insect which is represented on Woodcut LXIV. Fig. 4, is one of a group which contains many brilliantly-coloured insects.

The present species is called *Pyrrhocoris apterus*, and its colours are black and scarlet. The ground colour of the insect is scarlet and shining. On the top of the convex thorax is a broad black spot, square, with slightly rounded angles, and the abdomen is black also. On account of the preponderance of scarlet, the generic name of *Pyrrhocoris*, or Scarlet Bug, has been given to it.

The life history of this insect is a remarkable one. Sometimes, as in the illustration, it has fully-developed wing-covers, but generally the elytra are small and undeveloped, without possessing the usual membranous portion at the tip, whence the name of *apteris*, or wingless. Such creatures as these are termed 'imperfect perfect insects.' They were at one time thought to be pupæ, but it is now ascertained that they are really perfect with the exception of the full development of the flying apparatus. In some of the Heteroptera, such as the well-known Water Gnats, the imperfect perfect insects are as destitute of wings as they were when in the larval condition.

This is not a common species, though it has appeared in vast quantities in certain localities. Some years ago, the insect appeared in great profusion at Torquay, on some little islands;

and Mr. Curtis mentions, in his work on British insects, that, off Teignmouth, a rock in the sea was quite reddened with them. In fact they were as numerous as the ladybirds are in some seasons. They seem to be social insects, loving to collect together in groups rather than disperse themselves. Mr. Westwood states that in the neighbourhood of Berlin, especially in the gardens of the palace of Charlottenburg, the place swarmed with them, and that they were employed in sucking various fallen berries and seeds under the trees.

They also exhibited cannibalistic tastes. Owing to their great numbers, many of them had been trodden under foot, and these unfortunates were eagerly drained of their juices by their surviving comrades. It has been also noticed that, although these creatures will thus feed on dead insects, they do not meddle with living ones. This insect does not emit a disagreeable odour, fortunately for those whom it visits in such numbers.

It has been noticed that, in this group of insects, there are some that are brightly coloured, and some that are comparatively dull and sombre. Those species that are brilliantly decorated are mostly found on plants and flowers, as if anxious to exhibit their beauties, while their duller companions, as if ashamed of themselves and anxious not to bring themselves in contrast with their gorgeously clothed relatives, restrict themselves to the roots and lower parts of the stems.

The *Pyrrhocoris* belongs to a group termed *Cæcigenina*. This name, which signifies blindness, is given to the insects because they possess no ocelli. The second joint of the antennæ is the longest. As the word *apterus* signifies wingless, some entomologists have considered that it is not appropriate to this insect, on the ground that many specimens have fully-developed wings, while in others the wings are partly developed, and in none absolutely wanting. They have, therefore, suggested the specific name of *calmariensis*, by which it is known in several lists.

According to Mr. Curtis' theory, climate has some influence in the development of the wings, a hot climate forwarding it and a cold one retarding it. He stated that he had never found specimens in this country with the wings fully developed, though he had done so in the South of France. As, however,

a perfectly-winged specimen was taken by Linnæus in a latitude more northerly than that of England, the theory cannot be universally true, though it may be partially so.

ON Woodcut LXV. Fig. 1 is a curious-looking insect called *Neides depressus*, belonging to the family Berytidæ.

The members of this genus are remarkable for the length and slenderness of their bodies and legs, which very much resemble those of the water-gnats. This is not a handsome species in point of colour, yellowish-brown being the chief hue. The antennæ are rather light-yellow, and the edges of the front part of the thorax whitish-grey. The abdomen is black above, and the elytra are so transparent that they permit the colour of the abdomen to be seen through them.

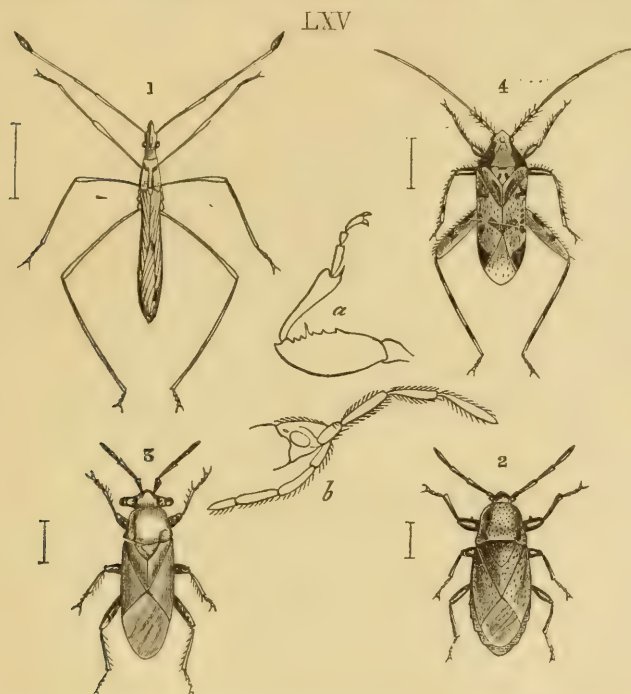
It is a local insect, living on plants that prefer the seaside. At Deal it has been found about the roots and stems of the hemlock stork's-bill (*Erodium cicutarium*), and in the Isle of Wight it has been captured under the common restharrow, or cammock (*Ononis arvensis*). Mr. Westwood states that he has found the *Neides* in all its stages under the last-named plant in a spot at the back of the Isle of Wight. The insect was very slow in its movements, and did not attempt to use its wings. As both larvæ and pupæ were found in the same situations, he thinks that there is no doubt that the *Neides* derives its nourishment from the plant under which he found it.

The chief point in this genus is the extreme length of the antennæ, which are as long as the abdomen and thorax together. The basal joint is extremely long, and when the insect is alive the antennæ are slightly elbowed at this joint.

NEXT in order comes the insect which is shown on Woodcut LXV. Fig. 2. Its name is *Rhyparochromus dilatatus*, and it belongs to the family of Rhyparochromidæ. The insects belonging to this genus are known by the two ocelli and the flattened and widened thighs of the fore-legs. In the present species this peculiarity is very strongly marked, and from that circumstance the specific name of *dilatatus*, or widened, has been given to the insect. The same joint is also remarkable for the very bold toothing of its inner edge, as may be seen by

reference to Fig. *a* on the same Woodcut. At Fig. *b*, a side view of the head is given, showing one of the antennæ, with its short first joint and long fourth joint, and the curiously formed hair-covered beak.

The generic name *Rhyparochromus* is formed from two Greek words, and signifies dirt-coloured, but I have not the least idea in what way it can be considered appropriate. The



1. *Neides depressus*. 2. *Rhyparochromus dilatatus*. 3. *Henestaris laticeps*.
4. *Phytocoris tilia*. *a*. *Rhyparochromus dilatatus*, leg. *b*. Do., head, antenna, and tongue.

colour of this species is as follows:—The general hue is glossy black, thickly clothed above and beneath with fine yellow down. The junctions of the joints of the antennæ and tarsus are yellowish. It is not a rare insect, and can be taken under moss.

ANOTHER family, the Henestaridæ, is represented by *Henestaris laticeps*, which is shown on Woodcut LXV. Fig. 3.

This is rather a rare insect, but has been found in the Isle of Wight in the month of August.

Its general colour is ochreous-yellow, clouded more or less with brown, and sprinkled with very fine yellow down. The ocelli are red. The upper part of the thorax is deeply punctured in front, and just behind the anterior margin are two black pits or depressions, which are well shown in the illustration. The thighs are thickly covered with black spots, which in many places coalesce and form blotches of black. The abdomen is black above and brown below, with a dash of ochreous-yellow. The specific name, *laticeps* or wide-headed, refers to the remarkable form of the head, which, including the eyes, is wider than the widest part of the body. This peculiarity is well shown in the illustration.

ON the same Woodcut, Fig. 4, is shown a much more striking insect, called *Phytocoris tiliæ*, as an example of the Phytocoridæ.

In these insects the antennæ are very long and slender, the first joint being as long as the head and thorax together. The hind legs are also very long, and the head is broader than it is long. The name *Phytocoris* is Greek, and literally signifies Plant-bug.

The colour of this insect is pale green, sometimes being so very pale as to appear grey with a slight greenish tinge, and being edged with a line of a darker hue. The insect is thickly clothed with patches of grey down, the grey hue being produced by the mixture of black and white hairs. It is rather a variable species, but mostly has the sides of the thorax black, and the tip of the elytra of the same hue. Sometimes the elytra are rather differently coloured, having two large black spots in the middle, and two smaller spots on the tip. The leathery part of the elytra is spotted with black. The second joint of the antennæ and the tibiæ are banded with black, and the remaining joints of the legs are pale yellow with black blotches.

As its shape imports, this is an active insect, and can both run and fly with agility. It is fond of fruit, and especially frequents raspberries, the juices of which it sucks through its beak. No great harm would be done by this small robbery if the *Phytocoris* would only content itself with abstracting juices. Unfortunately, while it sucks the liquids of the raspberry, it

deposits some of its own—that highly scented fluid which has already been mentioned, and, in consequence, so nauseous a flavour is imparted to the fruit that no one can eat it. The very odour is so powerful that it generally suffices as a warning to intending consumers. But, if by ill-chance one of them should be taken into the mouth, the flavour and odour are so utterly detestable that no one who has ever experienced them will allow himself to be again deluded. I can speak rather feelingly on this subject, having been victimised by this insect, and having therefore learned to test every raspberry before I venture to eat it.

WE now come to some very curious beings. On Woodcut LXVI. Figs. 1 and 2, is shown a remarkable insect, called *Systellonotus triguttatus*.

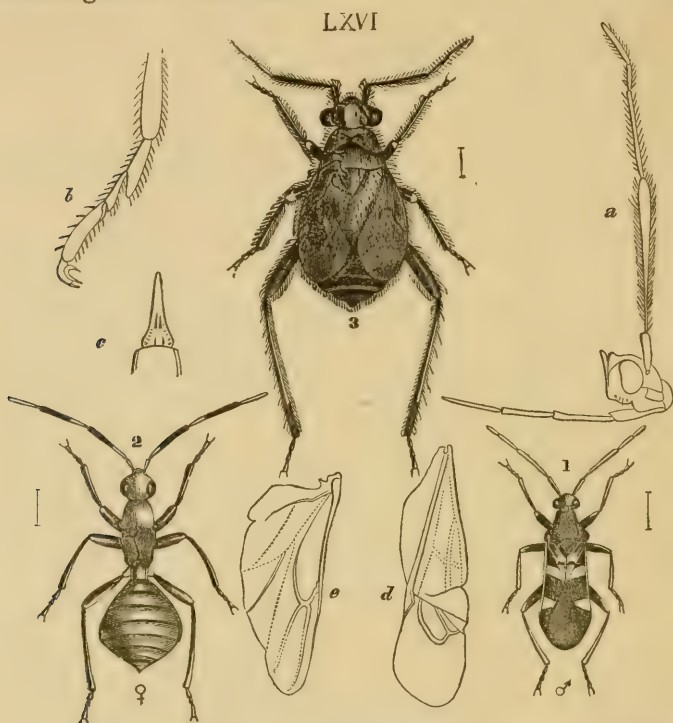
According to the older entomologists, this insect was placed in the same family with that species which has just been described. The modern entomologists, however, have broken up the old family, with many others, and have placed this insect in the family Idolocoridae. The insects of this genus are remarkable for the shape of the abdomen, which is very much narrowed or contracted at the base, where it joins the thorax. The generic name *Systellonotus* is composed of two Greek words signifying narrowed-back, and is therefore a very appropriate one. The shape of the abdomen can be best seen by reference to Fig. 2, which represents the wingless female.

The general colour of the male is reddish-brown, and over the body is spread a thin coating of yellowish down, which stands particularly upright. On each of the elytra are three white diagonal bars, one of a silvery character and the others greyish-white. It is from these three bars that the name of *triguttatus*, or three-streaked, has been given to the species.

The word *guttatus* is taken from the Latin *gutta*, or drop, and is applied to marks that are made as if by a drop of colour which had been allowed to run over the surface and then become dry. A good idea of the true shape of the *gutta* may be obtained by taking a white piece of paper, letting a drop of ink fall on it, and then holding it diagonally, so that the ink may trickle a little way down the paper.

The female, as may be seen by reference to Fig. 2, is almost

wholly without wings or wing-cases, these organs being merely indicated by some very small rudimentary appendages to the thorax. In colour they are yellowish-brown, and have none of the distinguishing characteristics of the Heteropteran wing. The insect is extremely swift of foot, and bears some resemblance to the wood-ant. Both sexes are rare, but the female is even scarcer than the male, and is a great prize to any entomologist who finds her.



1. *Systellonotus triguttatus*, male. 2. Ditto, female. 3. *Orthocephalus hirtus*.
 a. Do., head, antenna, and rostrum. b. Do., tarsus. c. Do., labrum. d. Do., elytron.
 e. Do., wing.

AN example of the restricted family Capsidæ is given on Woodcut LXVI. Fig. 3. This is called *Orthocephalus hirtus*.

Even to the unaided eye this is a remarkable insect, but is shown to be still more curious when examined with the aid of a microscope. The general colour of this insect is black, with a slight dash of yellow. If it be placed under the microscope, it will be seen that the ground hue is black, covered first with

golden-yellow scales, and then with rather long, erect black hairs which project between the scales. The elytra of the male are blackish-brown. In the male the upper part of the front part of the thorax or pronotum is bent down towards the head, whereas in the female it is straight. The thighs are long and black, and the tibiæ reddish-yellow, often tipped with black, as shown in the illustration.

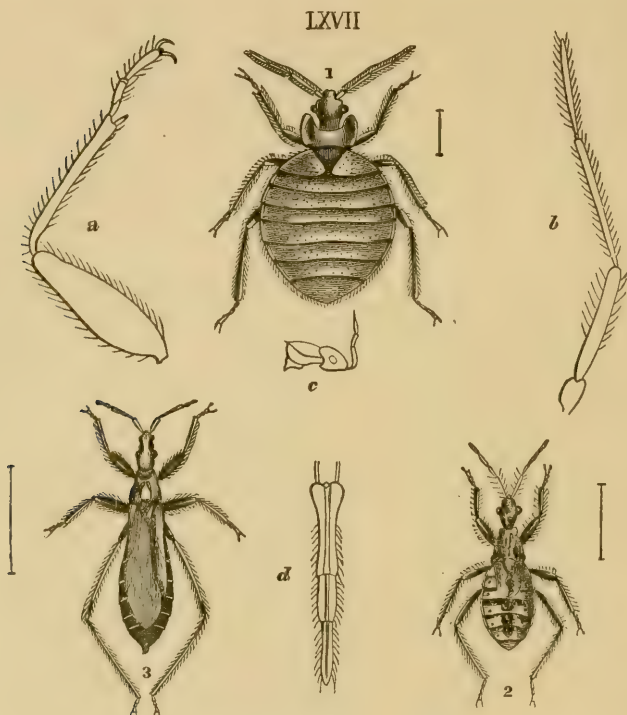
At Fig. *a* is given a profile view of the head, so as to show the very long second joint of the hair-clad antennæ, and the way in which the long, four-jointed beak is bent under the breast. The rather peculiar tarsus is shown at *b*, and the labrum at *c*. The word *Orthocephalus* is formed from two Greek words, signifying straight-headed, and the Latin specific name *hirtus*, or hairy, is given to the insect in allusion to the long black hair with which its body is covered. The shape of the elytron, or wing-cover, of the male is shown at Fig. *d*, and that of the true or flying wing at Fig. *e* of the same illustration.

THE family of the *Acanthiidae* is represented by the common BED-BUG (*Acanthia lectularia* or *Cimex lectularius*), which is represented on Woodcut LXVII. Fig. 1. In this genus the abdomen is nearly circular, and both sexes are almost without wings, their position being only indicated by a pair of little scale-like projections. Some entomologists assert that specimens have been found possessing perfect wings, but there is no satisfactory proof of any such development among the numbers that are annually killed.

When and how this singularly unpleasant insect was introduced into this country is not known; but there is no doubt that it is not indigenous, and that it was unknown some three hundred years ago. It is true that there are several allusions to the Bug in Shakespeare, as well as in older writers; but in every case the word does not allude to the noxious insect, but is taken in its original sense, namely, something that can terrify or annoy, and originally signifies some terrible spectre that walks by night. Thus in Ps. xci. 5, the word which is now rendered as 'terror' by night, was in the older editions of the Bible translated as Bugge, the allusion being evidently to spectral apparitions. It is still used in this sense in the word Bug-bear. We can easily see how an insect, newly introduced

into England, and spreading with a rapidity to which the customs of our ancestors gave every assistance, would be distinguished by a name which signified a nightly terror.

Being very flat and short-legged, and always walking with the legs in nearly the same plane as the body, the Bug can creep into very narrow crevices, and hundreds can hide themselves where there seems scarcely to be room for half a dozen. In the chinks of old furniture, and especially behind the wooden panels of old walls, they pack themselves so closely



1. *Acanthia lectularia*. 2. *Coranus subapterus*. 3. *Reduvius personatus*. a. *Acanthia lectularia*, fore-leg. b. Do., Antenna. c. Do., head, showing position of rostrum. d. Do., rostrum.

and in such numbers that they form thick layers of living insects, and the language of the carpenter in 'Punch' is hardly exaggerated when he said that if he were to take away a panel, they would get up on their hind legs, and bark like dogs.

The eggs of this insect are very small, and can be inserted

by the parent at the very bottom of the crevices in which she has made her home. There are four broods in the year, and each female lays, on an average, fifty eggs each time. When newly laid, the eggs are covered with a sort of varnish, which rapidly hardens when exposed to the air, and forms a cement by which the eggs are securely fixed to the object on which they are laid.

In some three weeks from the time that they are laid, the young Bugs are hatched. They are then so small as almost to be invisible, and, in fact, unless they have tasted blood, can hardly be seen except with a magnifying-glass. When, however, they have succeeded in attacking some human being, the extreme transparency of their skins causes the sucked blood to be seen through their tissues, and they look like tiny moving specks of scarlet. They attain their full growth in about three months.

As is the case with other blood-sucking insects, the Bug is rather capricious in its attacks. There are many persons whom it never touches, or at least, as I rather fancy, to whom it causes no annoyance if it does attack them; while there are others—myself among the number—who seem to be the centre of attack of every blood-sucking insect in the neighbourhood, and who suffer little less than torture from their venomous beaks. In attaining its prey, the Bug often displays much ingenuity. If it cannot otherwise get at a person who is lying on a bed, it will ascend the wall, crawl along the ceiling, and then fall on the bed, to the great discomfiture of its inmate.

I have remarked that in most cases those who are most obnoxious to the attacks of the Bug are most sensitive to its odour, and *vice versâ*. There were some rooms in Paris in which these abominable insects swarmed. They even came out in the daytime, and I have seen the little scarlet young perambulating the walls in the early morning. My olfactory nerves, however, were amply sufficient, without the sense of sight, to betray the presence of the insects, and yet the inmates of the room were absolutely insensible both in nostrils and skin to the presence of these abominable insects.

A still stronger case occurs to my memory. Some years ago at Oxford, I was visiting a working shoe-maker. The room was clean, and the walls neatly, though rather quaintly, deco-

rated with red wafers, like the spots on a toy-house. The odour of the room was, however, almost asphyxiating, and the air was so foul that some pure water which I had brought with me was covered with scum in a few minutes. On examining the walls a little more closely, I found that the imagined red wafers were nothing but Bugs, each of which had been smashed by a blow from the broad-headed shoemaker's hammer. Not one of the family, however, was in the least aware that the atmosphere within the room was more offensive than that without it, and none of them suffered any discomfort from the insects with which their house swarmed.

It is probable that the Bug does not absolutely require human blood, which is but a luxury to it. In its original condition it is said to live upon the juices of various trees, and to be able to procure nourishment from them even when the timber has been dried and made into furniture. Many entomologists believe that the first Bugs which were introduced into this country came over with the large cargoes of American timber that were used in rebuilding those parts of London which had been destroyed by the great fire of 1666. Some timbers, however, such as walnut, mahogany, oak, or cedar, are said not to afford them any nourishment.

The question of extirpating these insects is really an important one. Cleanliness and the increasing use of metal bedsteads have done much in lessening their numbers, but, despite all precautions, no house and no room is really safe from them. A single female may be brought to the house in the laundress' basket, find her way to some crevice, lay her eggs, and so found a large colony before their presence is fairly discovered. Various means of ridding the place of them have been tried, such as taking the furniture to pieces and painting all the joints with turpentine. Such means are effectual enough as far as the turpentine can reach, but no farther; and when the insects have taken up their residence in chinks of the wall, they cannot be subjected to turpentine or any other liquid.

It is evident that, in such a case, the insects can only be touched by vapour, and the question arises what vapour to employ. That of sulphur has been used with success, as has that of one or two other suffocating substances. But in any of these cases, the vapour must be so thick that no human being

can breathe it and live, so that there is an element of danger, and the after effects of sulphur vapour are anything but agreeable. I once had a room which was suddenly and grievously afflicted with these insects, and managed to clear it entirely from them without doing any damage to the house or furniture, or running the least risk of injuring any human being. There is a very valuable insect-powder, sold by Mr. H. Easter, of Cloudesley Square, Islington, which has the property of killing all insects, while it is quite harmless with regard to vertebrate animals, so that it can be sprinkled over birds, cats, dogs, and other animals without the least danger. My pet cat was once greatly tormented with parasites. I put a large teaspoonful of the powder into a bag, introduced pussy into it, much against his will, tied up the mouth, and left the bag on the floor. Of course, the cat tumbled about inside the bag, and rolled about the floor so as to introduce the powder thoroughly into the fur. In about twenty minutes I let out the cat, and found that every flea that had tormented him lay either dead or dying in the bag.

Finding this process so effectual I bethought me of trying the vapour upon aphides, moth-eaten fur, &c. &c., and, as the vapour was quite as destructive as the powder itself, I determined on trying it on a large scale. So I made a number of brown-paper cylinders, just like squib-cases, and filled them with the insect-powder, taking care to ram it down hard. I then pasted paper over every crevice that could let the smoke out of the room, or the air into it, lighted the squibs at the open end, blowing them into a bright red glow, disposed them about the room, and then closed the door, pasting paper from the outside across the junction of the door with the doorway.

After an hour or so, I took from the keyhole the cotton-wool which I had placed in it, looked into the room, and found that it was thick with smoke-wreaths. The smoke began to settle down in some three or four hours, and when it had nearly subsided, I entered the room and opened the window. The sight was an astonishing one. In every direction lay dead or dying Bugs, from the full-grown veteran to the tiniest larva. In some places where the smoke had not been very thick, the insects were still on their feet, but so stupified that they could only just put one leg before another. I am almost afraid to

say how many were captured, but it is sufficient to mention that they were counted, not by individuals, but by measure.

About a month afterwards, the process was repeated, for the purpose of killing those which had escaped on the first occasion, and the young larvæ which might have been hatched since the fumigation. Scarcely any survivors were discovered, and ever afterwards the room was quite free from them. It appeared that they had been introduced in a bedstead which had been warranted free from all insects.

It is said that spiders are great enemies to Bugs, and that they will destroy numbers of them if allowed to remain in the infested rooms.

Some years ago, I was very much perplexed, not to say annoyed, by the occasional presence of these insects in my dining-room, as well as in a bed-room immediately above it. I found at last that they came from some nests of the common house martin that were fixed just above the window. I got a long ladder for the purpose of examining the nests, and found their clay walls absolutely swarming with these insects. I tried a few experiments on a small lump of clay which was tenanted by them, and found that although they disliked the odour of turpentine, and crawled out of their refuge when placed in a tin box together with a piece of cotton-wool soaked in spirits of turpentine, they were not killed by it after an imprisonment of thirty-six hours, and rapidly recovered themselves when restored to the fresh air.

I was extremely sorry to disturb the martins, for I used much to enjoy watching the pretty birds so close to my window. But their parasites were so annoying that there was no alternative but to remove the nests and brush oil over the wall, so that the clay would not adhere when the birds tried to erect new nests in the same spot. Some entomologists think that these insects are not the same species as the *Acanthia lectularia*. Whether this be the case or not, they have the same unpleasant habit of attacking human beings and the same abominable odour, and must be extirpated ruthlessly. They will travel for considerable distances from the nests in which they are hatched. I have seen four or five of them creeping along a wall and making their way to a window which was not only much below the nest, but quite on the opposite side of the house.

A few of the details of this insect's structure are given on Woodcut LXVII. At Fig. *a* is shown one of its fore-legs, at Fig. *b* the antenna, with its slender terminal joint. Fig. *d* is a greatly magnified representation of the beak, and Fig. *c* shows a profile view of the head together with the beak.

It has already been mentioned that the spider will destroy the Bed-Bug. There is one of its own relations, however, which performs this operation much more effectually. It is popularly called the FLY-BUG, and its scientific name is *Reduvius personatus*. A rather enlarged portrait of this curious insect is given on Woodcut LXVII. Fig. 3. This insect is an example of the Reduviidæ.

The colour of the Fly-Bug is brown, sometimes blackish, and sometimes with a yellowish tint. The tibiæ are yellow at their bases, and the abdomen has a shining surface, black below, but with a yellow patch in the middle above.

The insect is sometimes found within houses, but is generally taken on account of its habit of flying towards light, and so entering at night windows of lighted rooms. Mr. E. A. Smith tells me that at Deal he found several Fly-Bugs lying dead under a window-sill. Both in its perfect and preliminary stages, the Fly-Bug feeds on other insects, and has such a liking for the Bed-Bug that a room has been cleared of these obnoxious insects by the introduction of a few Fly-Bugs.

In its larval and pupal states, this insect has a habit of enveloping itself in a thick coating of dust and other refuse, and is so addicted to this practice that, after it has shed its skin and come out all bright and clean, it has been seen deliberately to take the dust coating from its shed skin and place it on its new coat. The specific name of *personatus*, or disguised, has been given to the insect in consequence of this habit. The *Reduvius* is a much more formidable enemy to the Bed-Bug than the spider, for the latter has to wait for the chance of its prey coming to its net, whereas the former is a hunter and seeks prey for itself. An entomologist in my neighbourhood, who kept a larva of the *Reduvius*, found that it would eat three or four Bugs daily, so that a few of these insects, if at liberty, must cause great havoc among our 'Norfolk Howards.'

Apart from the service which it renders, this *Reduvius* is not

a very pleasant insect. Its odour is scarcely less disgusting than that of its wingless relative, and, if captured, it has a very unpleasant way of driving its beak into the fingers of its captor. Under such conditions, it also emits a rather sharp creaking sound, which is said to be produced by the friction of the elytra.

ANOTHER example of the Reduviidæ is given on Woodcut LXVII. Fig. 2. It is called *Coranus subapterus*.

In all the Reduviidæ the beak is comparatively short, thick, and more or less curved. The head is so narrowed behind as to form a neck. There are two ocelli, the eyes are very prominent, and the terminal joints of the antennæ are slender. The legs are long and active. Many of these insects have the wings only slightly developed, so that they come under the category of 'imperfect perfect insects.' Such is the case with the present species, which has derived its name of *subapterus* (a most barbarous compound, by the way) from the structure of the wings, which only reach as far as the third segment of the abdomen.

I really do not like to translate such a word as *subapterus*, which is a repulsive hybrid between Latin and Greek, and—with all respect to the eminent entomologist who first manufactured it—ought not to be accepted in its present form. What, for example, should we think of such words as eightagon, twelvehedron, dreiangle, petitscope, telesseer, insectology, etoilonomy, erdology, and so forth? Yet there is not one of these words which is one whit more ridiculous than *subapterus*. Should we be allowed to talk, much less write, of a hemiglobe, an eggpositor, a chaudmeter, a baromeasurer, a virful deed, or a megananimous sentiment? But, if we are to retain the one word, there can be no reason why we should not employ the others.

However, the name being given and accepted, let us see what it means. The preposition 'sub,' when prefixed to adjectives, gives them a partial sense. Thus, *subiratus* means rather angry; *subdoctus*, moderately learned; *subcandidus*, whitish; and so forth. But, in all these cases, both parts of the word belong to the same language. Had the offending entomologist used the word *subalatus*, or partly winged, no one could have objected to it, as both words are Latin. Apart from other reasons, it is a prettier-looking word than *subapterus*.

and much easier to say. But when he employs the word *sub*, which is Latin, as a prefix to the Greek *pteron*, I do not see that we should be called upon to excoriate our own ears and those of future generations with such an atrocious compound.

I believe that brown sugar and oysters are considered incompatible, as is salt with strawberry cream. There is, perhaps, not one in ten thousand who would not feel direfully aggrieved by having any such mixtures forced on him as part of his daily diet. And there is really no more reason for offending our eyes, ears, and mental taste by *subapterus*, than our mere palates by the above-mentioned mixtures.

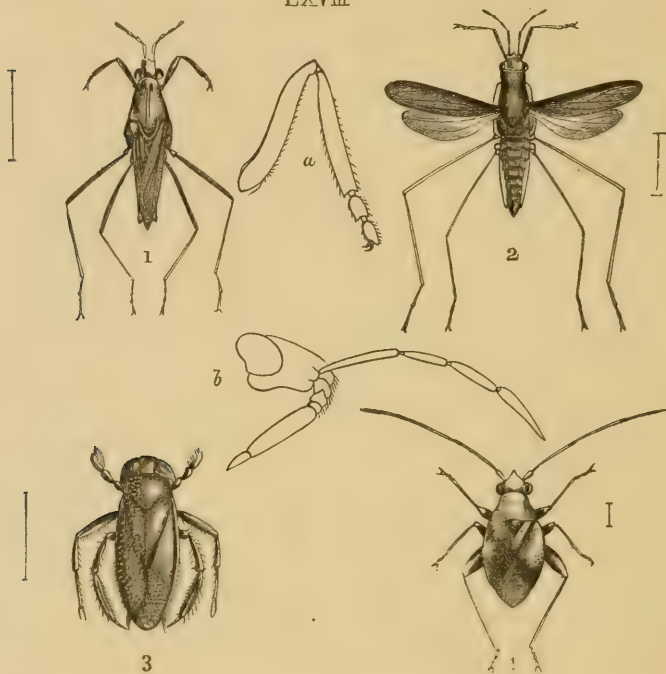
The general colour of this insect is dusky black, relieved by a clothing of short, yellow hairs. Beneath it is yellowish-brown. The ocelli are red and the antennæ pale brown. The membranous portion of the short wing is rather contracted, and the nervures are black. It is found in dry, sandy places, hiding under heath, furze, and other plants. When handled, it gives out an odour which, unlike those of most of its kind, is of a pleasant nature, and bears some resemblance to that of a ripe pear. Although in most cases the wings of this insect are in the imperfect state which has just been described, they are sometimes, but very rarely, fully developed.

WE now come to that group of Heteroptera which has been mentioned as passing most of their time on, though not in, the water. They are scientifically called Hydrometridæ, or Water-measurers, because they seem to measure the surface of the water with their long and slender legs; and they are popularly known by the name of Water-gnats, because the smaller specimens have some resemblance to gnats without their wings. Two specimens of this group are given on Woodcut LXVIII., in order to show the aspect of the insect in different attitudes.

In all these insects the body is long, narrow, and is mostly covered on the under-surface with a fine coating of velvet-like hairs, which are capable of resisting the action of the water. The beak is rather long, curved under the breast, and the last joint but one is considerably longer than the others. Some of them run over the surface of the water with great speed, their middle pair of legs acting as propellers, their hind legs as

rudders whereby they direct their course, and their fore-legs stretched out in front for the purpose of seizing their prey. When the insect is at rest, these legs are folded under the body in the attitude which they assume when the prey is held against the breast, so that the long, curved, sharply-pointed beak may be driven into it. One of these prehensile legs is shown at Fig. *a*, and a profile view of the head, so as to show the form of the beak, with its long penultimate joint, is given at Fig. *b*.

LXVIII



1. *Hydrometra gibbifera*.
4. *Halticocoris luteicollis*.

2. *Hydrometra argentata*.
a. *Hydrometra argentata*, fore-leg.

3. *Corixa Geoffroyi*.
b. Do., head, with

These insects afford many examples of the imperfect-perfect state, which has been the trouble of most entomologists until its true nature was cleared up. In this condition, the Hydrometridæ so exactly resemble pupæ, that when they were seen exercising all the functions of the perfect insect, the observers were naturally perplexed.

Those specimens in which the wings are fully developed can use them well. I have noticed that, when alighting in the water after flight, they always use their legs for the purpose of tucking the wings under the elytra, just as the earwig uses its forceps and the rove-beetle the end of its flexible tail. With these legs they wash themselves frequently, appearing to be singularly fastidious respecting cleanliness. I have often seen these insects standing on the three legs of one side, while employing those of the other side in brushing the body, every portion of which was carefully passed under the feet. The attitude is most singular, and I have never seen it adopted by any other insect.

They are all predacious, seizing their prey with their fore-legs. I have seen one of these creatures, having caught an insect, hold it out in front of its body with its fore-feet, while making its way to some place where it could in safety suck the life-juices of its prey. Predacious as they are, they also fall victims to larger inhabitants of the water—the well-known Water-boatman making great havoc among them, and taking on the average five or six minutes in sucking dry the body of its prey.

The name of the species shown at Fig. 1 is *Hydrometra gibbifera*. Its colour is blackish-brown above, and beneath it is black, with a silvery or brassy lustre when seen in a side-light. The specific name of *gibbifera*, or bunch-bearing, is given to it on account of a rounded tubercle or bunch upon the anterior angles of the thorax. The male has also a large orange-coloured tubercle on the back of the thorax, near its junction with the abdomen. There is a short, thick, yellow line drawn longitudinally on the middle of the front part of the thorax. The elytra are blackish-brown, with a slight blue gloss in certain lights, and the nervures are clothed with golden hairs and scales. The middle pair of legs is the longest. This species is very common on the surface of water, whether it be stagnant or running.

ON Woodcut XLVIII. Fig. 2, is shown another species, *Hydrometra argentata*.

This insect is remarkable as being the smallest of the family. Its colour is blackish-brown above, with a decided silvery gloss below. The antennæ are black. The colour of the elytra is

brown in some lights and bluish-grey in others. The abdomen of the male has the last two segments marked with a narrow yellow line, and that of the female has the last four segments similarly marked. It is much rarer than the preceding insect.

THE last of the Aurocorisa which will be mentioned in this work is the insect which is represented on Woodcut LXVIII. Fig. 4. Its name is *Halticocoris luteicollis*, and it belongs to the family of Halticocoridae, or Jumping-Bugs, because they have the capability of leaping, very much like the Halticæ, or Turnip-fleas, which have already been described on page 211. The structure of the hind legs, with their greatly developed thighs, is sufficient to show that the insect is gifted with the power of leaping.

The general colour of this insect is shining black, over which are spread a number of fine yellow hairs, very short, and bent downwards. In this species the elytra are fully developed, but in the only other British species of this genus, *Halticocoris pallidicornis*, they are undeveloped. The head and antennæ are ochreous yellow, and so are the legs except the thighs of the second and third pairs, which are black. The upper part of the thorax is very finely wrinkled in front, and has a very fine and delicate furrow running along its centre.

The insect is not a scarce one, but requires to be looked after, as it takes up its residence in clover fields, and upon several species of Bed-straw (*Galium*). The sweep-net will generally bring it within the reach of the entomologist.

ON Plate XVIII. Fig. 4, is shown a figure of an insect called *Pentatoma dissimile*. The insects of this genus have the scutellum very large, the tarsi with three joints, and the eyes rather prominent. In some of the family to which this insect belongs, the scutellum is of enormous size, from which the family has derived the name of Scutellaridae. The generic name *Pentatoma* signifies 'five-pieces' or joints, and is given to the insects because their antennæ have five joints. Like others of the same order, they exhale a very unpleasant odour, and sometimes render uneatable any fruit over which they crawl. They are mostly vegetable feeders, but sometimes take

to animal food, a number of them having been observed gathered round the body of a caterpillar, with their beaks sunk deeply into it. The well-known naturalist, De Geer, states that some species of this family watch over their eggs until they are hatched, and then take care of their young, just as is said of the earwig. He remarked that the mother reminded him of the hen and her chickens, leading them from spot to spot, and evidently keeping guard over them until they were strong enough to shift for themselves.

The same naturalist further observed that these insects can disengage the piercing portion of the proboscis from the sheath, and replace it at will. His description is as follows. I have not his work by me, but follow the translation given in Griffith's edition of Cuvier's 'Animal Kingdom.'

'It has happened to me,' says De Geer, 'to observe on one of these young bugs, placed under the microscope, that its proboscis was entirely disengaged out of the furrow of the sheath. It hung then at the end of the tongue, like a very long thread. I saw, again, that at the end of the thread the three pieces of which it was composed were separated one from the other. The following day I observed on the same bug that everything was restored to its proper place—that the proboscis was placed, as before, in the furrow of the sheath. It appears, then, that the bug can withdraw its proboscis out of its sheath and put it back when it thinks proper. It drew the proboscis out of its sheath once again; I then saw how the intermediate part of the proboscis and of the point played—how the bug elongated and shortened it alternately. I saw some drops of fluid come out of and re-enter the proboscis. The two semi-sheaths which accompanied it played also alternately in front and rear.

'I was attentive to observe how the bug caused its proboscis to re-enter into the furrow of the sheath, and at last I achieved this, after having observed it without interruption for more than a quarter of an hour. It first of all puts its proboscis in a parallel line with the sheath, or at least it holds it extended the entire length of the sheath; afterwards it gives an inflexion to the sheath, about the middle of its extent. It folds it like a knee. It then applies this knee against the middle of its

proboscis, or against that part of the proboscis which is opposite to the knee. The anterior feet then come to its assistance. The bug presses its proboscis with its feet against the sheath, so that this portion of its proboscis is then stopped in the groove or furrow. Finally, it presses the rest of its proboscis against the sheath with the same feet, and thus causes it to slide into the groove. As soon as the proboscis has once re-entered, it stays there.'

CHAPTER II.

HYDROCORISA, OR WATER-BUGS.

WE now come to the second group of Heteroptera—the Hydrocorisa, or Water-Bugs. There are many species, differing greatly in external appearance; but they all have very short antennæ concealed in cavities beneath the eyes, and their fore-legs are rather short, and can be folded close to the body, so as to look like claws. With these limbs the insects seize their prey, which consists of various inhabitants of the water that do not appear to be so strong as themselves.

THE first family is that of the Notonectidæ, which embraces the various insects known by the popular name of Water-boatmen. The scientific name signifies Back-swimmer, and both titles are equally appropriate. The Notonectidæ have a habit of lying on their backs in the water, and their body then assumes a shape very much like that of a boat. The two hind legs are exceedingly long, and as they are stretched out at right angles with the body, look exactly like oars, and indeed are used as if they were oars. The ends of these legs are furnished with hairy fringes, which act like the blade of the oar, and enable the insect to drive itself along with very great speed.

All who have handled an oar know of the difficulties which beset them in the proper mode of feathering, i.e. turning the oar as it is brought out of the water, so that the edge of the blade is turned to the air as the oar is swept backwards for the next stroke. In the oar-like legs of the Water-boatman we find a provision for a similar feathering, the bristles standing out boldly as the leg is forced against the water to make the next stroke, and collapsing as the limb is drawn through the water in readiness for the next stroke. The insect never lifts its oar-legs out of the water, and, unless some provision of the sort were made, it would travel nearly as fast backwards as

forwards. In fact, the movement of the Water-boatman's leg very much resembles that of the North American Indian's paddle. He never takes the paddle out of the water, but first makes his stroke with the flat of the blade, and then turns the paddle so that its edge is presented to the water as it is brought forward in readiness for the next stroke.

One of these insects, *Notonecta glauca*, is shown on Plate XIX. Fig. 2.

THE manners and customs of the Water-boatmen are well worthy of study, and I have passed many pleasant hours in watching their habits, both at liberty and in captivity. As a rule, they lie on their backs in the water, but they do not always maintain this position. On fine, hot, summer days, they turn over and sit almost on the surface of the water, with the wing-cases half open and the wings partly protruding from them. In this curious attitude they will sit for an hour at a time, and even more unless disturbed, as long as the sun shines on them. It is remarkable how mere attitude will alter the aspect of an insect. The Water-boatman, as it appears when darting through the water, and when sitting sunning itself on the surface, is so totally different in aspect, that no one who was not acquainted with the insect could suspect its identity.

As is the case with aquatic insects in general, the Water-boatman breathes atmospheric air, respiration being conducted much like that of the Water Beetles, which have already been described. In the case of the Water-boatman, however, the comparative transparency of the elytra enables the mode of respiration to be seen better than can be done with the beetles. I have often watched the breathing of the *Notonecta*, which is conducted as follows. The insect lies on its back, with its legs spread, the tip of its tail just above the surface of the water, and its head just below it. Air is taken into the space between the elytra and the body, and is passed onwards towards the shoulders, being alternately taken in and ejected through the spiracles, and its course being traceable by the quicksilver look which it gives to the elytra. Having completed its course through the respiratory system, the air is squeezed out at the junction of the elytra with the under part

of the thorax, and ascends in bubbles to the surface. There is always a small bubble of air at that point, which continually increases in size until it is detached from the insect, rises to the surface, and gives way to another.

The wings of these insects are large and powerful, and can carry their owner at a considerable speed. The insect is even able to take to flight directly from the surface of the water, an accomplishment which startled me in no small degree when I first saw it. When it wishes to fly, it dives to some little distance below the surface, so as to bring itself into a perpendicular position, with its head upwards. It then darts upwards, giving a smart stroke with both its swimming legs as it reaches the surface. By this stroke, or leap, it is jerked several inches out of the water, when it spreads its wings suddenly, and with a loud, dull humming sound, much like that of a wasp on the wing, flies away.

In common with the rest of its kin, this is a predacious insect, feeding almost entirely upon other aquatic insects. It does not eat them, but seizes them with its fore-legs, clasps them tightly to its body, drives its beak deeply into them, and sucks out their juices, leaving their bodies scarcely altered in form. I have often watched the *Notonecta* seize other inhabitants of the water, and thus kill them. When it has once clasped an insect in its fatal hold, it can scarcely be induced to release it until it has finished its meal, but swims about, holding its victim firmly pressed against its body until all its juices are sucked out.

It pays a great regard to its personal cleanliness, and is fond of washing itself much after the fashion of the house-fly, using its fore-legs for this purpose, and passing them over every part of its body, the head being moved and twisted from side to side exactly like that of the blue-bottle under similar circumstances.

The larva and pupa of the Water-boatman resemble the perfect insect in habits as well as in form, excepting that the former has not even a vestige of wings, and the latter only exhibits them in their rudimentary form; consequently they are unable to fly, and their whole life is passed in the water.

The proboscis or beak, which is employed by the Water-boatman in draining its victims of their juices, is very strong

and sharp, and can be used as an instrument of defence at the will of the insect. If the Notonecta be seized carelessly, it will drive its beak into the hand, causing a sharp, smarting pain, which at the moment so closely resembles the sting of a wasp, that few persons can resist the instinctive action of dropping the insect. No real harm, however, can be done, and the pain goes off almost as rapidly as it was caused.

There are many species of Water-boatman, the insects being arranged in several genera; but, as the form and habits of them all are very similar, there is no need for further description.

An allied group of insects is known by the generic name of *Corixa*. A magnified view of the commonest of these Water-boatmen is shown on Woodcut LXVIII. Its scientific name is *Corixa Geoffroyi*. In these insects the scutellum is not visible, because the thorax is prolonged over it. The fore-legs, although they are used for prehensile purposes, are not so entirely raptorial as those of the Notonectæ, and the tarsus is composed of a single long pointed joint, fringed on the inner edge with stiff bristles. The middle legs are slender, as are their claws, and the long hind legs have the two tarsal joints fringed, and are used for swimming. The body is much flattened above, and this peculiarity alone is sufficient to distinguish it from the Notonectæ, with their boat-like backs. The beak is short but sharp, and can inflict a smart prick on the fingers if incautiously seized.

Mr. Westwood remarks that in the winter time he has seen great numbers of *Corixæ* huddled together under the ice, most of them grasping each other with their legs. They appeared to be stupified with the cold, and to have no idea of devouring each other.

The present species is blackish-brown, with a slight yellowish tinge. Upon the upper part of the thorax are a number of small yellowish spots, arranged in transverse rows, and sometimes running into each other, so as to produce the effect of delicate, irregular stripes. The head is yellow, and the eyes and beak are black. If the elytra be examined with a tolerably powerful magnifying glass, they will be seen to be covered with very fine hairs of a pale yellow tint.

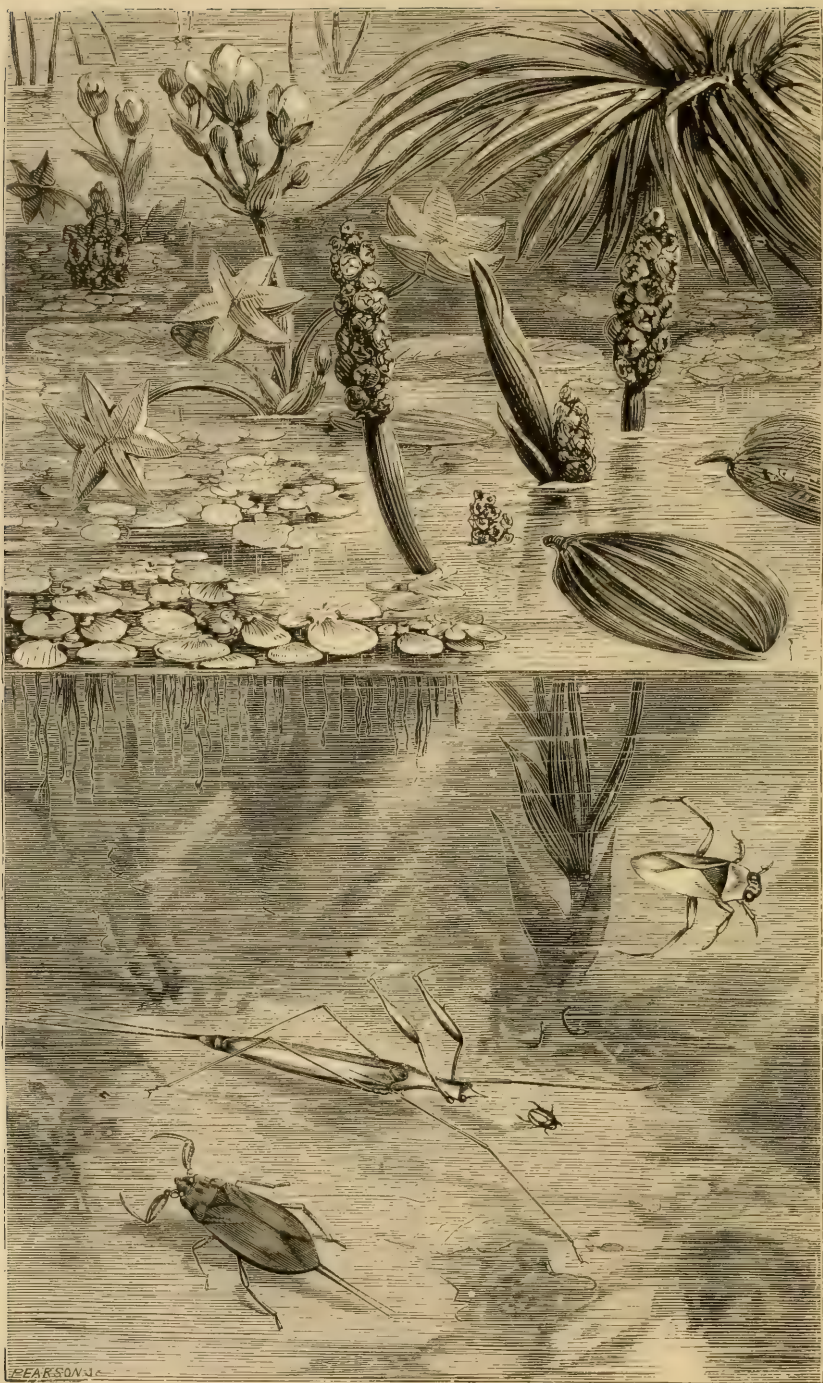
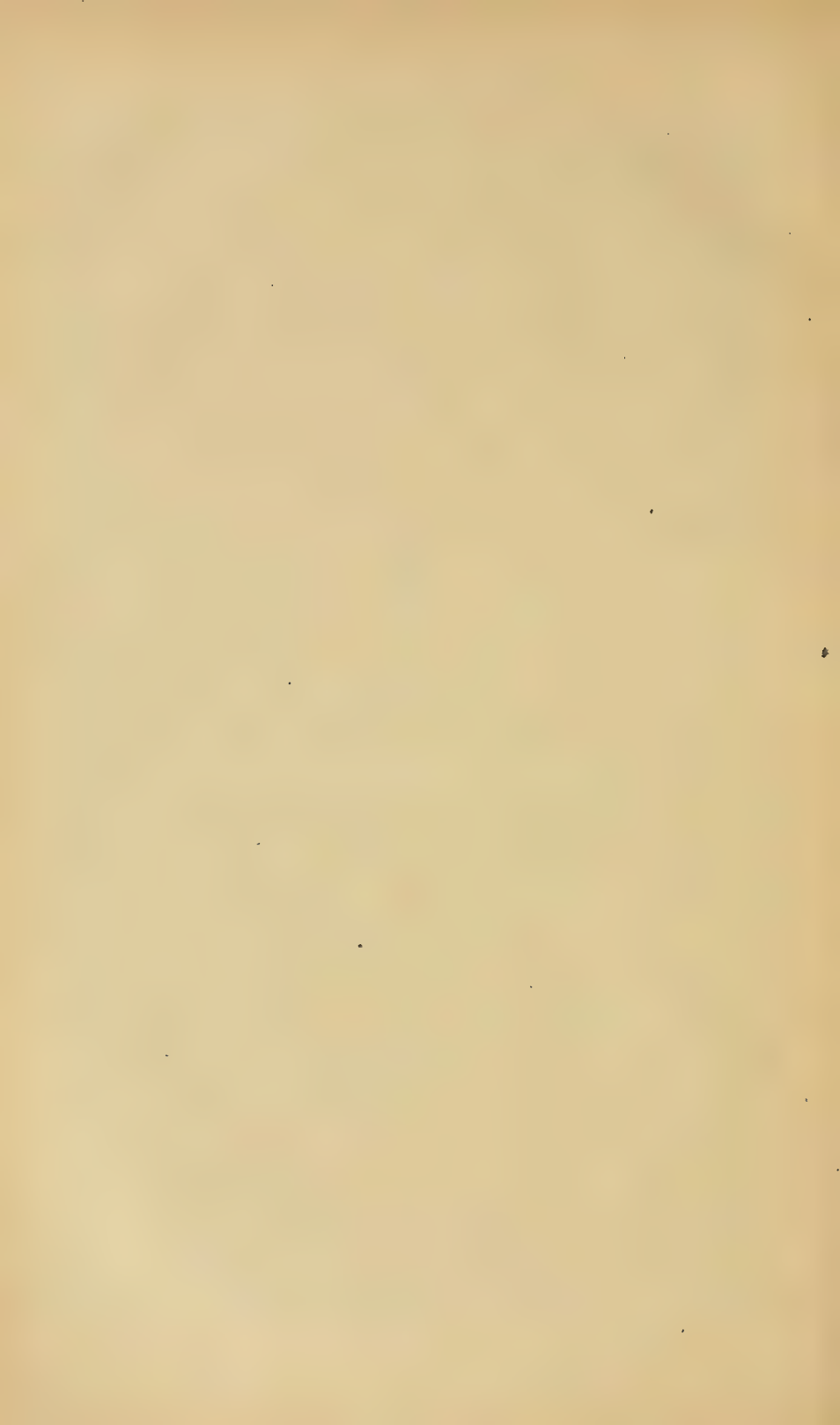


PLATE XIX.
AQUATIC HETEROPTERA.

1. *Ranatra linearis*.
2. *Notonecta glauca*
3. *Nepa cinerea*.

PLANTS:—

Duckweed (*Lemma*). On surface of water.
Various-leaved Pondweed (*Potamogeton heterophyllus*).
Starwort (*Aster tripolium*).



The insect is common in some places, and can be taken in company with the Notonecta as it darts through the water. I have taken great numbers of them in the Swindon Reservoir, and, as far as I know, all my specimens were taken in that spot.

THE next family is that of the Nepidæ, popularly known as WATER-SCORPIONS, of which we have but three British examples. The best known of these insects is the common WATER-SCORPION, which is shown on Plate XIX. Fig. 3. Its scientific name is *Nepa cinerea*. The Nepidæ may be easily known by the flat and leaf-like body and the shape of the first pair of legs, which are formed for seizing prey, their joints doubling upon each other as the blade of a clasp-knife is doubled into its handle. The other two pairs of legs are formed for walking.

In some of the species, the end of the tail is furnished with two long, slender, bristle-like filaments, which look very much like an apparatus of offence. They are, however, adjuncts to the respiratory system, and serve to conduct the air to the spiracles while the body is submerged. In these insects the spiracles are placed quite at the end of the body, those of the sides being only indicated by rudimentary marks. In the larval state these filaments are represented by a single sharp point.

Unlike the quick, dashing, and wary Water-boatman, it is a slow, crawling, inactive insect, and, if seen creeping among the plants near the water side, can be picked up with the fingers; indeed, it is so very sluggish in its movements that, as it is predacious in its habits, and depends for its food on the capture of other inhabitants of the water, it seems hardly capable of gaining a subsistence. There is, however, but little difficulty in this respect. The Water-scorpion lies quietly among the aquatic plants until some luckless insect comes by, when, with a rapid clutch of its fore-legs, the victim is captured, and held tightly until its juices have been extracted. When in the water, the insect looks so exactly like a small dead leaf, that the quickest eye might fail to discern it as long as it did not move. It is probably on account of this resemblance to a leaf that the Water-scorpion is able to secure its prey, which consists mostly of the larvæ of aquatic insects, such as the Mayfly and Whirlwig beetle.

The eggs of this insect are of a most singular shape, the base of each being furnished with seven horn-like projections, arranged in a circle. Before the eggs are laid, the horns of one egg act as a cup, into which the end of the next egg is received; but when they are deposited, the horns bend backwards, so as to form a circle of hooks around the upper end of the egg.

As is the case with all the British *Nepidæ*, the colour of the Water-scorpion is dull brown. When, however, the elytra are opened, the upper part of the body is seen to be of a brick-red, which also tinges strongly the base of the wings.

THERE is a closely allied insect, called scientifically *Ranatra linearis*, which resembles the Water-scorpion in many particulars. This insect is shown on Plate XIX. Fig. 1.

This is more active than the preceding insect, and uses its fore-legs in a most wonderfully skilful manner. With these legs it seizes its prey, which consists mostly of aquatic insects; but the *Ranatra* is not very particular, and will attack anything, so that it be alive. The larvæ of the Mayfly are its favourite food, but I have seen it eat various other creatures, especially the freshwater crustacea. It is really a fierce being, and, if attacked, has no idea of flight, but boldly assumes the offensive. I have seen one of these insects fight a piece of stick in a most determined manner, striking at it fiercely with its long fore-legs. When so acting, it has a most formidable aspect, as may be seen by reference to the illustration.

The wings of the *Ranatra* are packed away very neatly, but are quite large enough to bear their owner through the air. Mr. Westwood mentions that he has seen the *Ranatra* alight in a pond, and have great difficulty in forcing itself beneath the surface of the water, on account of the dryness of the two bristle-like appendages of the tail.

THE last British species of this family is called *Naucoris cimicoides*, and is easily distinguished by possessing no filaments at the end of the tail. The body is not so flat as that of the Water Scorpion, and the hind legs are formed for swimming. It is very much more active than either of the preceding insects, and in the water looks so like the Water-boatman that it might easily be mistaken for that insect. The fore-legs are

raptorial, and the thighs are extremely large and powerful. I have taken great numbers of this insect in the Swindon Reservoir, and been made practically acquainted with the power of the beak and its capability of piercing the human hand. The beak, though it be short, is very strong and very sharply pointed; and when the insect is at rest, the end of the beak exactly reaches to the base of the fore-legs.

APHANIPTERA.

APHANIPTERA.

CHAPTER I.

PULICIDÆ, OR FLEAS.

THE rather long word with which this chapter is headed is formed from the Greek, and signifies ‘Non-appearing Wings.’ This name is given to the insect because the wings are not visible to ordinary observation, being merely represented by four very minute scales on the thorax, the upper two of which are the rudiments of the first pair of wings, and the lower of the second pair. Popularly, they are known as FLEAS, and are rather more familiar to us than agreeable.

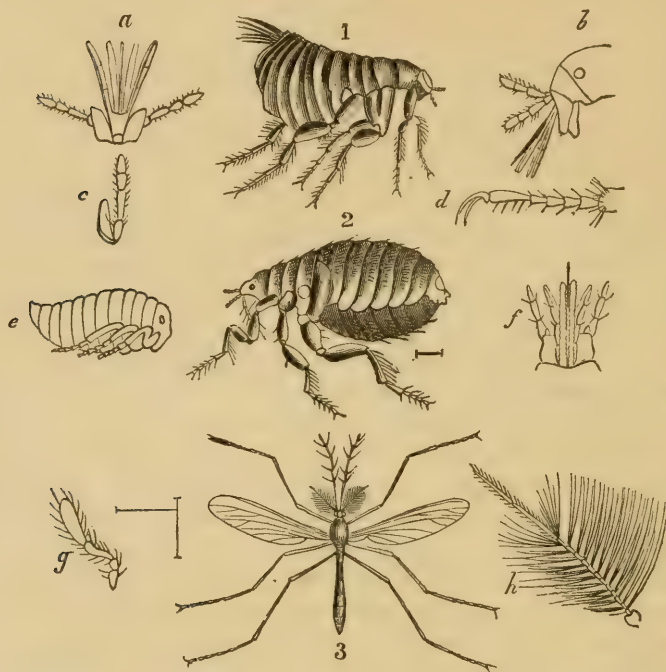
When placed under the microscope, the Flea really becomes an interesting insect, with some share of beauty about it. The body is rather narrowed, or ‘compressed,’ as is the correct term; it is covered with a very hard, shining, horny skin, on which are rows of short and sharp bristles, having their points directed backwards. It is owing to these bristles and the projecting edges of the horny segments, that to hold a Flea in the fingers is so difficult a task. By means of its powerful limbs, the insect forces itself through the fingers a very little at a time; but, however short may be the progress at each struggle, it is still a step towards freedom, for the bristly rings very effectually prevent it from being forced back into the position from which it had escaped.

The hind legs are formed for leaping, and it is by their means that the insect takes such prodigious jumps. It can crawl as well as leap, and indeed, does crawl by preference, only jumping when it thinks itself in danger.

The beak, or rostrum (called a rostrulum by Kirby and

Spence), is exceedingly complicated, but is formed of modifications of parts of the mouth which already existed, and not of entirely new organs. Indeed, like the beak of the suctorial Heteroptera, the beak is formed of the lips and jaws, which are modified so as to suit the wants of the insect. These organs, though similar in character, vary much in form in the different

LXIX



1. *Pulex talpæ*. 2. *Pulex irritans*. 3. *Culex pipiens*, male. a. *Pulex talpæ*, mentum and palpi. b. Do., side view of head. c. Do., palpus. d. Do., tarsus. e. *Pulex irritans*, pupa. f. Do., mentum and palpi. g. *Culex pipiens*, male, palpus. h. Do., antenna.

species, as may be seen by reference to Woodcut LXIX. Figs. a and f, of which the former represents the mouth of the male Flea, and the latter that of the common Flea.

The transformations of this insect are worthy of some notice. The female Flea lays a very few eggs, seldom more than twelve in number, and deposits them in any convenient spot. Hearth-rugs are favourite resting-places for these eggs, and so are the little crevices in the floor or walls in which the adult insects

hide themselves during the day-time. In due course of time these eggs are hatched, and produce larvæ in the shape of tiny white grubs. These larvæ are entirely without feet, but push themselves along by means of the hairs which are attached to the segments of the body. The last segment has two little hooks, the use of which is rather obscure. Perhaps they may be used in order to afford a fulcrum by which the body can be retracted, just as the stiff hairs afford points by which the creature can be urged forward.

Be this as it may, the larvæ are very active little beings, twisting about with great agility, something like those of the gnat. The food of this larva is said to consist of the fleshy part of the feathers and the blood of animals, but I very much doubt this statement. I do not venture to deny that the larva will feed on these substances, *when it can get them*; but, seeing that at least ninety-nine per cent. of Flea-larvæ now living must have been without access to mammalian blood, or fresh feathers, this kind of food cannot be universal. Indeed, I have often wondered how Fleas support life, and, unless they feed on each other, I can scarcely understand their mode of supporting existence.

When I was at school, I had the misfortune to suffer a simultaneous dislocation and fracture of the ankle, and was conveyed to the infirmary, a large room at the top of the house. Now, this room had been without tenants ever since I remembered it, and I believe that for at least seven years no human being had entered the room, except to open the windows in the morning and shut them at night. The room was kept most scrupulously clean, and no one even imagined that a Flea was in it.

That the room was tenanted by these insects I found to my own proper cost. No sooner was the candle put out than a simultaneous attack was made on me in all directions. From every part of the room Fleas came in battalions. There was a nurse in the room, who was one of those persons that are either impervious or objectionable to Fleas, and she escaped them entirely, while they concentrated all their energies on me.

Now, a damage such as I had suffered is not conducive to rest, even with all appliances. The limb swells, until the skin feels almost unable to resist the tension, and the burning heat

is as if melted lead were being continually poured over the joint. Fever rages through the frame, and the first endeavour of the surgeon is to subdue it as much as possible. Under such circumstances, it may well be imagined that the ceaseless attacks of the Flea armies were not calculated to produce quietude, and, indeed, had the occupier of the bed been in perfect health and strength, one such night would have sufficed to drive him into a fever. The only portion of the skin that escaped was that which was covered by the bandages, and even there the dreadful little insects had found out the junctions of the bandages, forced themselves under the edges, and driven their beaks into the skin, so that when the bandage was removed in the morning, its course could be traced by the rows of fleabites.

The insects had never enjoyed such a chance of a banquet in their lives, and naturally made the most of it. But, I cannot but wonder on what food they had subsisted before any wretched human being was delivered over to them. Generation after generation must have been hatched, lived, and died, and never even seen a particle of blood. No animals of any kind ever remained in the room, which was entirely disused, and, as I have mentioned, only entered for a minute or two daily, and that at a time when all the Fleas were safe in their hiding-places.

The larvæ are hatched about the beginning of autumn, pass the winter in the larval condition, and change to pupæ in the spring of the following year. One of these pupæ is shown on Woodcut LXIX. Fig. 2. When it first escapes from the larval skin it is white, but it rapidly assumes the well-known reddish-brown hue of the perfect insect. In this state it is perfectly quiescent, the legs being enclosed in separate cases, and so remains for about a fortnight, when it throws off the pupal skin and emerges as a perfect Flea, ready to exercise its wonderful apparatus of laceration and suction, if it should only be fortunate enough to find a subject.

The Flea is possessed of an amount of muscular power which is really enormous in comparison with the size of the insect. How great is this strength is shown by the performances of the Industrious Fleas, of which we have all heard, and which some of us have seen. One of these insects will draw behind it a weight

which is as much disproportioned to the size of its body as would be one of Pickford's largest and heaviest-laden waggons to a human being. With the leaping powers of the Flea we are likewise familiar, though perhaps we have not reflected that the average jump of a Flea is about thirty times its own height, and that, supposing a man of six feet in stature were to perform the same leap, he would jump as high as the gallery of the Monument.

THERE are many species of Flea known to entomologists. Mr. Westwood states that the largest specimen that he has seen was captured on that curious animal, the Echidna, or Porcupine Ant-eater, of Australia. This insect measured no less than one-sixth of an inch in length, which is to most Fleas what a man of twelve feet in height would be to ordinary human beings. One of the largest Fleas that inhabit this country is that which is parasitic on the mole, and is therefore called *Pulex talpæ*. A portrait of this odd-looking insect is given on Woodcut LXIX. Fig. 1. At Fig. *a* is shown the mentum or chin of the MOLE FLEA, with its palpus at either side, and its apparatus of lancets in the middle. The profile view of the head is given at Fig. *b*, so as to show these organs in a different position. One of the palpi is shown at Fig. *c*, as it appears when severed from the head, and the foot is drawn at Fig. *d*.

The COMMON FLEA (*Pulex irritans*) is shown at Fig. 2 of the same illustration, and the reader can easily see how different are these two species, even in external appearance. The mentum, palpi, and lancets are shown at Fig. *f*.

Besides these, almost every animal has its own species of Flea, each of which has some characteristic points in which it differs from its congeners, and can be recognised with the aid of the microscope. Fortunately, in this country we have no Flea which can inflict any real damage on us. It can annoy us terribly, but there its power ceases. In the West Indies, however, there is a Flea, popularly called the JIGGER, or CHIGOE (*Pulex penetrans*), which makes its way under the skin, especially of the toes, lays its eggs there, and, if it be suffered to proceed in its task unmolested, fearful ulcers come,

and the damage has been known to be so great that amputation has been necessary in order to preserve the life of the patient. The Chigoe, not being a British insect, must not be described in these pages; but no history of the Flea, however short, would be complete without a reference to this small but dangerous insect.

DIPTERA.



DIPTERA.

CHAPTER I.

THE last Order of Insects is the DIPTERA, i.e. those insects which have only two transparent wings, incapable of being folded. In strict accuracy, these insects really have four wings, but one pair is undeveloped, and only represented by two little projections called halteres, or balancers. These will be described presently. The wings have generally at their bases a pair of little winglets, or 'alulets,' which are not separate wings, but merely appendages of the true wings. The tarsi have five joints. There are other distinctions, but these are amply sufficient for our purposes.

Now, let us give a short time to the examination of the halteres. If the reader will take any Dipterous insect—the common Daddy-long-legs is as good an example as can be found—and look at the thorax with a magnifying glass, he will see that the development of that part of the body is very curiously managed.

The front division, or the 'prothorax,' is very small, so small indeed that it is scarcely more than a collar, just large enough to afford support to the first pair of legs. The middle division, or 'mesothorax,' is enormously large, the reason being that it has to carry not only the middle pair of legs, but the upper pair of wings, and must therefore afford space for the muscles which move those organs. And, as in the generality of the Diptera, the wings are moved with singular rapidity, it is evident that their muscles must be proportionately large. The last division, or 'metathorax,' is larger than the prothorax, and much smaller than the mesothorax. It carries the hind pair of

legs below, and the balancers above. These organs, which are the rudiments of the under wings, are generally shaped like tiny bristles tipped with a round knob, and they are furnished with muscles by which they can be kept in a state of rapid vibration. So important are these organs that, even in those Diptera in which the upper wings are wanting, the halteres are present.

Their small size renders them useless for the purposes of flight, but it has been proved that they serve in some mode to guide the flight—how, it is not easy to say. The ordinary shape of these balancers can be seen by reference to the insect which is represented on Woodcut LXX. The word ‘halteres’ is Greek, and signifies an adjunct to gymnastics, which has long been abandoned. Those athletes who competed for the wide jump, used to take in their hands the halteres; i.e. a pair of iron and leaden weights, and, as they made the spring, they swung the arms forward, so that the impetus of the weights should add to the force of their leap. They were also employed of a larger size, for the purpose of exercising the arms, much as we use dumb-bells.

Other peculiarities of this Order of Insects will be mentioned in the course of the following pages.

WITH regard to the arrangement of these insects, there has been much controversy between systematic entomologists, and much yet has to be done in this respect. As, however, this is not a purely systematic work, but deals more with the actions than the comparative anatomy of insects, we will accept the system of Professor Westwood, a system which he has elaborated with great labour and skill. He divides them first into two great Sections, the first of which he calls CEPHALOTA, because the head is quite distinct from the thorax, and not sunk into it. The larva undergoes its transformation without the body of the parent, and the claws of the tarsi are not toothed. The first of these definitions, however, is quite sufficient to enable the observer to know in which section he ought to place any fly that may come before him.

This section he again separates into two Divisions, the first of which is the Nemocera, or Thread-horned Diptera, in which the antennæ have more than six joints, and the palpi have

either four or five joints. The second is the Brachocera, or Short-horned Diptera, in which the antennæ have not more than three distinct joints, and the palpi not more than two joints, and often only one.

The first Division embraces those insects which are popularly known as Gnats and Daddy-long-legs, and scientifically as Culicidæ and Tipulidæ. We will begin with the former, and take as an example the COMMON GNAT (*Culex pipiens*), the male of which is represented on Woodcut LXIX. Fig. 3.

In this family, the parts of the mouth are developed into a long beak, rather thickened at the end, and being generally about half as long as the head and body of its owner. The beak is better studied from a female than a male specimen, as only in the former is the complicated structure fully developed. The beak consists altogether of seven pieces, some being used as lancets, which the insect can drive into the substances on which it feeds, and the others act as sheaths or strengthening pieces. Owing to the very small size of the Gnat the dissection of the beak is a very difficult process. Mr. Westwood, however, has succeeded in accomplishing it, and his account is briefly as follows. ‘All the parts of the mouth of a mandibulated insect are here observable. There is a broad and hollow lancet-like piece, representing the *upper lip* (which is the most robust part of the mouth, except the labium); a pair of slender, needle-like pieces, as the *mandibles*, which are serrated on the outside at the tip; a second pair of similar, but much more slender organs, dilated at the base, representing the *maxillæ*, to the bases of which the palpi are attached; a very slender, needle-like instrument, representing the *tongue*, and the outer tubular canal, in which the others lodge when at rest, representing the *lower lip*.’

I have slightly abridged the above description, and inserted the italics, in order to point out more strongly the analysis of the parts, so that the reader may see that the beak of the Gnat, with its apparatus of lancets and suction-tube, is formed of exactly the same elements as the mouth of the Stag-Beetle which is represented on page 9.

I strongly recommend any reader who has access to a microscope to examine carefully the head and thorax of the Gnat, both male and female. The Gnat is a singularly unpleasant

insect in a room, but it is marvellously beautiful under the microscope, and should be examined both with direct and transmitted light, and with a succession of powers, beginning at the lowest and ending at the highest, so as to gain its beauties of detail by degrees. The antenna of the male, for example, which is represented on Woodcut LXIX. Fig. *h*, is a wonderfully beautiful object. There are fourteen joints, and each joint is furnished with a whorl of long hair, disposed as seen in the illustration. The same portion of the female has the whorl of hair so short as to be invisible without the aid of a lens. Then again, the beak, the wings, the limbs, and the body generally are studded with beautiful scales, resembling in form those of the Lepidoptera, but more deeply grooved, and having the ridges prolonged beyond the end, so as to form a row of little spikes. These scales are so plentiful, so easily detached from the insect, and so readily recognised, that if a Gnat should have been kept in a box in which various other insects have been placed, the microscope will detect upon all the later comers some of the scales of their predecessor.

These scales give to the insect a splendour of colouring which cannot be appreciated until the microscope is brought to bear on it, and which entirely baffles any power of description. So I recommend my readers to look for themselves, and to place the first Gnat that they catch under a microscope, taking care to concentrate upon it as brilliant a light as they can obtain. When they have done this, they will begin to realise some of the wonders of Fairyland, and to see actually before their eyes splendours which the most daring fairy tale has but faintly pictured. Dull and colourless as the Gnat may appear to the unaided eye, it has only to be placed under the revealing glass of the microscope to blaze out in a magnificence which would pale all the fabled glories of Aladdin's fairy palace. I have no doubt that all this splendour is perfectly visible to the eyes of the insects themselves, and that the beauties which are hidden from us until we have recourse to artificial vision, are seen and appreciated by the insects whose bodies they adorn.

To descend to more prosaic details—though after all, the history of every insect is really a poem—we must bear in mind that, though both sexes partake of this splendid apparel, the male does not possess the skin-piercing lancets with which the

mouth of the female is armed. The male Gnat, in fact, is perfectly harmless, and it is to the female alone that we owe the annoyances which have rendered the sight of the delicate little insect hateful to our eyes, and the really musical hum of its wings a terror to our ears.

In this favoured country, we know little of the powers of the Gnat. We often suffer very considerable inconvenience and annoyance from them, as I can testify, having twice in the summer of 1870 lost the use of my right hand for a week together in consequence of a single gnat-bite. In both cases the bite took place just at the junction of the thumb and the wrist, and in both cases the effect was the same. The hand swelled until it looked like a boxing-glove, was purple in colour where it was not crimson, the fingers could neither be closed nor opened, and the only mode of subduing the fierce heat of the hand was by carrying it in a sling, and having a piece of ice fastened on it over the spot where the Gnat had inserted her beautiful but objectionable beak. I did not fully recover the use of the hand for full three weeks after the bite had been inflicted.

Such being the effect of a single gnat-bite in England, we may form some idea of the terrors of this little insect in the countries where it is known as the Mosquito, where the venom of its bite is increased tenfold, and its numbers are multiplied by millions. Life is absolutely rendered a burden by these tiny insects, which assume to themselves the mastery of the country in which they live. There are some parts of the world where the Gnat has absolutely driven the human inhabitants from the land into the water. For some reason, not at present ascertained, the Gnat never lives at any distance from land. It may travel inland for miles from the spot where it was hatched, but it will not willingly travel to any distance over the water. Knowing this peculiarity of constitution, the inhabitants of such spots have taken advantage of it, and made their homes on the bosoms of lakes, supporting them on piles driven into the ground.

Here we really have no idea of the vast Gnat armies that besiege other lands. Even in parts of Russia, as we are told by Dr. Clarke from his own experience, no amount of gloves, handkerchiefs, and thick clothing could defend man or woman

from the Gnats. On one occasion, on a close sultry night, when not the slightest breeze was stirring, and in consequence every breath of air was priceless, he was driven to take refuge in his carriage, and to shut all the windows. Now closed windows, although they may exclude those Gnats which are outside the carriage, cannot eject those that are already in it, and they were so numerous that Dr. Clarke was forced to tie several handkerchiefs over his head, in spite of the sultry weather. Setting these handkerchiefs at defiance the Gnats got into his mouth, crawled up his nostrils, and forced themselves into his ears. In despair, he tried to light a lamp and succeeded, but the flame was instantly extinguished by the Gnats, who flew to the light, and poured in such numbers down the glass chimney that a large conical heap of their bodies lay over the burner.

As for remedies, it is no easy matter to recommend them. I have an idea that the remedy must suit the idiosyncrasy of the sufferer, and that a prescription which suits one person admirably will have little or no effect upon another. For my own part, I have found that *arnica* serves to keep down the swelling and irritation better than anything else. This year, 1871, I have been bitten several times, but have applied *arnica*, and found that it saved a vast amount of torture. There was some swelling and considerable irritation, lasting for several days, but the aggravated symptoms of the preceding year did not show themselves.

The life history of the Gnat is very interesting. When the female is about to deposit her eggs, she proceeds to the nearest water, and there sets about the last task of her life. Placing her front legs on a piece of floating stick, straw, or anything that will support her tiny weight, she allows the middle pair of legs to rest on the surface of the water, and crosses the hind pair so as to look like the capital letter X. She then deposits a rather long and spindle-shaped egg, and places it upright with the base downwards in the angle of the X. Another egg is quickly placed by the side of the first, and followed by others, all of which are glued together by a cement which is not affected by water. Guided by the crossed legs, the eggs are formed into a boat-like shape, and are then left to float on the surface of the water.

These little egg-boats are quite plentiful in the summer-

time, and any number can be taken for the purpose of experimenting. Their shape very much resembles that of the life-boat now in use, and, like the life-boat, the egg-boat cannot be sunk, and if capsized rights itself again immediately. Even if some of these boats be placed in a vessel of water, and the contents of the vessel be poured from a height into the pond, the little boats float at once to the surface like so many corks, and each, as it rises, assumes its proper position.

In due course of time the larva is hatched, pushes off the lower end of the egg, which opens like a little circular trap-door, and allows itself to float off into the water. The larva is a quaint-looking little being, with a long body terminated at one end with a large round head, and at the other with a forked tail. When examined through the microscope the larva is a most curious creature, the semi-transparency of the body rendering the internal organs almost as plainly visible as if there were no skin at all. The young and small larvæ, which have just shed one of their successive skins, are better for microscopical examination than those of a larger size, because their integuments become more opaque with age. Through the centre of the body the digestive organs are marked by their darker hue, and just above them pulsates the 'dorsal vessel' which stands in the stead of a heart.

On either side of the body runs a rather dark tube, and the two, joining each other at the angle of the fork of the tail, turn off to one of the points of the fork, and run side by side along it. These tubes are the two principal canals of the respiratory apparatus, as is easily seen by putting a high power to the microscope—say, an object-glass magnifying some two hundred diameters. When this is done, the spiral thread which is coiled round the breathing tube of insects becomes plainly visible, and at once declares the character of these dark vessels. At regular intervals smaller vessels branch off to the other parts of the body, and the tubes are finally lost in the comparatively opaque head.

After shedding the larval skin several times, the pupal state is assumed. In this condition the future Gnat can move about with some activity, but it cannot take nourishment, all the apparatus of its mouth being enveloped in the pupal skin. After passing a short time in this state, the pupa cracks along

the back, and through the aperture the head and legs of the Gnat show themselves. In a short time the Gnat draws itself entirely out of the pupal shell, and uses it as a kind of raft on which it can stand while it shakes out its damp and crumpled wings. So small a creature does not require any long time for this process, and as soon as it is completed the Gnat flies merrily away.

I have been often asked to give some hints as to the extirpation of these insects. There are but very few that can be given. In all places where ponds and stagnant waters are near, nothing can be done. But I find that the chief nursery of the Gnat is the open rain-water-butt.

The ordinary cover is useless as a protection from Gnats, as the delicate little flies can insinuate themselves through very small crevices. With regard to my own butt, I first nail down the ordinary wooden cover, and then run a broad strip of canvas round the upper part of the butt, fastening the lower edge to the butt, and nailing the upper edge on the wooden cover. I also caulk with tow any crack in the cover, and with the same substance fill in the space between the rain-water pipe and the sides of the hole in the cover through which it passes. There has been a notable diminution of Gnats since these precautions were taken, and I am sure that if every water-butt were similarly protected, the number of Gnats that get into houses would be diminished at least ninety per cent.

Reference has been made to the too familiar hum of the Gnat. This sharp and almost trumpet-like sound has been carefully investigated, and by means of an instrument known as the Siren it is possible to count the number of beats made in a given time by the wings of the Gnat. The Siren is an instrument which can produce any required number of vibrations, and as they are produced registers them on a dial. Now it is found that when the vibrations exceed a certain number per second, a definite musical sound is produced, the sound or tone becoming sharper in exact proportion as the number of vibrations becomes greater. So, if a Gnat be heard to hum, and a Siren be forced to produce the same note, the instrument not only gives the exact note, but registers on its dial the number of vibrations required to produce that note—in other words, the number of vibrations of the Gnat's wing per second.

Here it must be mentioned that these wings are moved in a very curious manner. It was formerly thought that they passed into the cavity of the thorax, and were worked by means of the powerful muscles attached to their bases. Such, however, is not the case. Let any reader take a fly—one of the many Hoverer flies is perhaps the best—kill it, and press the point of a pin lightly on the middle of the thorax. It will be found that as soon as the point of the pin presses the thorax, down go both the wings, so that in fact the movements of flight are made by the action of the thorax to which the wings are attached, and not by the action of muscles directly connected with the wing. In point of fact the wing moves by the rapid contraction and expansion of the mesothorax, such movement being caused by the powerful set of muscles within it.

There is much more to be said about the Gnat, but our rapidly diminishing space warns us to proceed to another typical insect.

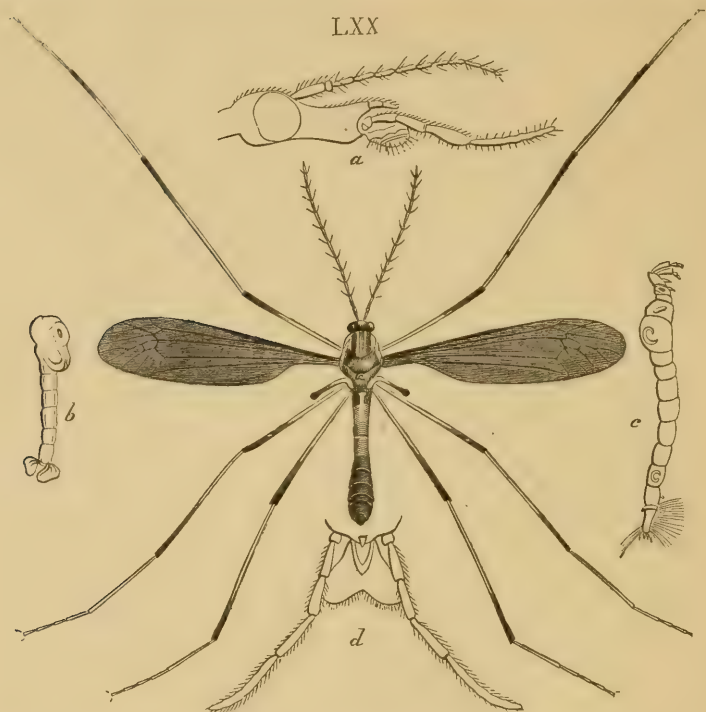
ON Woodcut LXX. Fig. 1, is represented one of our finest British examples of the insects called by the popular name of DADDY-LONG-LEGS, or CRANE-FLY.

The name of this particular species is *Tipula longicornis*, the latter name being given to it on account of the great length of its antennæ.

In the family of Tipulidæ, to which this insect belongs, the proboscis is very short, with its internal organs very slightly developed. The legs are very long and slender, as is the body, and the alulets are almost wholly wanting. The larvæ of some of the Tipulidæ live in the water. Those of the genus *Chironomus* are long, slender, scarlet, and worm-like, and are well-known under the name of Blood-worms. The rain-water butt is a favourite nursery of these insects, and their larvæ may often be seen in the ewer, jerking and twisting about like little bits of scarlet thread endowed with life.

The general colour of the present species is ochreous-yellow. The thorax is black, with a slight ashen-grey down, and there is a yellow semi-lunar spot before each of the wings. The abdomen has a short slate-coloured streak down each side. It is a tolerably common insect, and can be seen while flying along hedge-rows in the dusk.

The life history of all the members of the genus *Tipula* is very similar. The eggs are laid in the ground by means of the sharp ovipositor which is seen at the end of the abdomen of the female, and, when she is seen in the act of depositing her eggs, the object of the long legs is evident. She always chooses some grassy spot, and then stands almost erect on her hind legs



Tipula longicornis. a. Side view of head, showing antenna, palpus, and mouth. b. Pupa.
c. Larva. d. Front view of mouth, showing the two lobes.

among the blades of grass, with the point of the ovipositor on the surface of the ground. She then begins to turn her body from side to side, just as the carpenter turns a bradawl when he wishes to bore a hole in a plank, and in a short time is enabled to deposit an egg beneath the surface of the ground. This done, she goes to another spot and repeats the process, until she has deposited all her eggs.

When the young larvæ are hatched, they make their way

among the roots of the grasses, on which they feed. One of these larvæ is shown at Fig. c. They are tough-skinned, hard-headed beings, and do incalculable damage to our lawns and pasture lands, sometimes cutting away the roots of the grass so completely that large masses of turf are completely separated from the soil, and can be rolled up by the hand as if a turf-cutter had been under them. There is no remedy against these grubs which is half so effective as the starling. This bird has a wonderful power of detecting the presence of the subterranean larva.

If any of my readers will get up very early, so as to be abroad at day-break, and will hide himself in some convenient nook near a grass lawn, he will see how the starlings can work for the benefit of man. They evidently employ the sense of hearing as their principal mode of discovering their prey, and may be seen with the side of their heads pressed against the ground, evidently listening for the unseen grub. When they have made up their minds, there is no delay, for the bird gives half a dozen sharp pecks, thrusts its beak deeply into the ground, gives a strong pull, and hauls out the *Tipula* larva, which it has seized by the head. It does not eat the grub, but flies off with it, still holding it by the head with the very tip of its beak.

The pupal form of this insect is shown at Fig. b. When the pupa is about to change into the perfect form, the pupa issues partly out of the ground, and the skin then splits and allows the perfect insect to escape.

For the following interesting details of the Daddy Long-legs, I am indebted to the Rev. J. W. Brooks, Great Ponton Rectory, near Grantham:—

‘Some years since, when I was Vicar of Nottingham, I turfed over a small plot in the garden at the back of my house with turves procured from a sandy meadow in the neighbourhood. They proved to be full of the eggs of the Fly above named; and in the spring the grass portion of the garden, comprehending only about three hundred and fifty square yards, was swarming with their grubs, with which I had not previously been acquainted. They were sluggish-looking larvæ, curled, and apparently harmless. It was not until the period of their escape that I discovered what they really were, and

killed about twelve hundred by hand-picking, giving them a squeeze in the head as they were taken.

‘I did not, however, at that time understand their habits, or the slaughter would have been greater. It was not until the latter part of the year that I noticed that the Fly comes forth from the earth at twilight—chiefly in the evening, but in the morning twilight also. They may then be easily taken by pacing about upon the grass, and watching them as they emerge. To aid their capture the grass should be kept close cut during the season of their appearance. I killed upwards of two thousand in the second year, and in the fifth year of their invasion, I saw no more of them.

‘I observed that the male commonly leaves his case in the earth, and begins to fly immediately on his emerging therefrom; or, after the lapse of a minute or so, while he rests upon the grass. He is small and active, and scuttles about close to the ground in a zigzag manner, like a spaniel in search of game.

‘The female, being fat and plump, particularly towards the end of the abdomen, often cannot extricate herself from the old case in which she has been entombed, as the abdomen sticks fast in the upper part of it, which is the narrowest. I have seen them shoot up by the half-score together in the twilight of a soft summer’s evening, unable to bring the case fully out of the ground. The wings at their extremities frequently remain encased together with the abdomen, and thus the insect is prevented from struggling except with its fore-legs.

‘I have measured them when in this position, and found them, with the case attached, two inches and a half in length. Both sexes are of a light blanché colour on their first coming forth from the ground; but a few minutes with the female, and a few seconds with the male, change them to their usual dusty-drab.

‘The reason of the active, searching motion of the male quickly becomes apparent—he is hunting for the female. As soon as he discovers one of them in the hampered position already described, he rushes to her aid, and with his fore-legs drags her out of the light pupa-case. The insects remain together for several hours, and may thus be destroyed before the female has had time to deposit her eggs.

‘If the mornings or evenings are frosty or damp, the insects are dull and torpid, and may easily be taken with the hand; but if the weather be hot and dry, they are lively and saucy, and fly away as the captor approaches. They are, however, so silly, that often, when they seem to be flying away, they rise up in the air, make a short gyration, and descend, with a sudden dart, at his very feet.

‘The time of the appearance of the perfect fly varies according as the season has been warm and dry or cold and damp. In the course of the four years that I watched for them, their first appearance varied from the eighth of August to the fifth of September, and their disappearance from the fifth to the thirtieth of September. The process of transformation from the larva to the fly continued, in the entire community of them, from twenty-one to twenty-five days.’

The pupa of this insect is shown at Fig. *b*. Fig. *a* represents a magnified profile view of the head of the perfect insect, and Fig. *d* is the front view of the mouth.

WE now come to the second division of the Cephalota, namely the Brachocera, or Short-horned Diptera. They are divided into smaller groups, or Stirpes, as Mr. Westwood calls them. The first of them is the Notacantha, or Thornbacks, in which the antennæ are apparently composed of only three joints (of which the last is seen, when examined by a lens, to be articulated), and the proboscis seldom contains more than two lancets. The pupa is enclosed in the skin of the larva, which, however, retains its previous shape instead of being formed into an oval cocoon, as is the case with the common flies and bluebottles. We can only take one example of this group, the FORKED CHAMELEON FLY (*Stratiomys furcata*), which is represented on Woodcut LXXI. Fig. 3. In this genus the proboscis is very short, and the basal joint of the antennæ is much longer than the second. The third joint is apparently very long, but the microscope shows that it is composed of several joints fused together, as may be seen by reference to Fig. *b*.

Most of the insects belonging to this family are beautifully coloured, and many of them shine with metallic tints, mostly

tending to purple. The present species is rather variable in colouring, whence one of the three species derives the name of Chameleon. It always, however, has a velvet-black body, on which are a number of bold yellow patches, arranged as shown in the illustration. The legs also are yellow. There are three species all very much alike in colouring, and almost identical

LXXI



1. *Asilus crabroniformis*. 2. *Asilus germanicus*. 3. *Stratiomys furcata*. 4. *Eristalis tenax*. a. *Asilus crabroniformis*, tarsus. b. *Stratiomys furcata*, antenna. c. *Eristalis tenax*, antenna.

in their life history. The larva of this insect is an odd-looking creature, long, slender, and worm-like, with its segments very strongly marked, and gradually diminishing in diameter towards the tail, which is furnished with a star of radiating hairs. As is the case with the larva of the Gnat, that of the Chameleon-fly breathes through the end of the tail, the larva remaining suspended with its head downwards and its star-tipped tail at the surface. The life history of the COMMON

CHAMELEON-FLY (*Stratiomys Chameleon*) has been so tersely and fully given by Mr. F. Walker in his 'Insecta Britannica,' that I cannot do better than transfer his account to these pages:—

'These flies feed on the honey of flowers, and appear in the spring and in the summer on aquatic plants: their flight in hot weather is very rapid, but short, and they quickly return to the spot whence they took wing. The larvæ are aquatic, and the metamorphosis of *Stratiomys Chameleon* has been often observed.

'Its eggs from white become green, and then change to orange-green; they are arranged like tiles on a roof, one laid partly over another, on the underside of the leaves of *Alisma plantago*, the water plantain. The larva often remains suspended by its radiated anus at the surface of the water, with its head downwards. Its ganglions are so near each other as to appear like a string of beads. When it is disposed to sink to the bottom or to descend, by bending the sides of its tail, so as to form a concavity, it includes in them a bubble of air, in brilliancy resembling silver or pearl, and then sinks with it by its own weight: when it would return to the surface it is by means of this bubble. If it moves upon the surface or horizontally, it bends its body alternately to the right and left, contracting itself into the form of the letter S, and then extending itself again into a straight line: by these alternate movements it makes its way slowly in the water. It has much resemblance to some of the *Polypi vaginati*. The last joint of the pupa retains the exact form of the larva-body, is extremely long, and terminates in an orifice to receive the air, which is surrounded by a circle of about thirty diverging rays, consisting of beautifully feathered hairs or plumes.

'The feathery hairs are so prepared as to repel the water, and thus to suspend the animal by its tail at the surface, and preserve a constant access of air. When it has occasion to sink, it turns these hairs in and shuts the orifice, carrying down with it an air-bubble that shines like quicksilver, and, as is conjectured, enables it again to become buoyant when it wants to breathe. The dorsal vessel (series of hearts, or artery) is attenuated at both ends. The ovaries of the fly are agglomerate, and the egg-tubes form two bundles, in which the branches are not discernible.'

The last-mentioned fact is a very curious one, as all will admit who have dissected insects. I have dissected a vast number of insects, representing every order, and nearly every important group in entomology, but I never dissected a Stratiomys, and never saw the remarkable structure which Mr. Walker mentions.

When the larva is about to undergo its change to the pupal form, the larval skin hardens, without much alteration of its shape, and within this cover the pupa becomes developed. Being much smaller than the larva, the pupa only occupies a portion of the larval skin, so that a large space is left, rendering the pupa and its case much lighter than water, and enabling it to float at liberty on the surface.

WE now come to the next group, or Stirps, of the Cephalote Diptera. They are called Tanystoma, or Long-mouthed Flies, in consequence of the construction of the mouth, which is generally very prominent, and is furnished with a lancet-like labrum and tongue. The larvæ are very worm-like, without feet, and having the head hard and scaly. They live underground, and there pass through their transformations, as we shall see in our short history of the following insect.

On Plate XX. Fig. 1 is represented the GREAT BREEZE FLY, GAD FLY, or CLEG (*Tabanus bovinus*), one of the largest of our Dipterous insects. Its colour is rather variable, but its general effect is brown, sometimes deepening into dark-brown and yellow, with chestnut triangular marks down the centre. It has very much the aspect of a large bee, and its wheeling flight and loud hum serve to strengthen the similitude. The mouth is armed with most formidable lancets, and the insect, at least the female Breeze Fly, can employ them with terrible effect. The tough skin of cattle is no defence against the lancets of the Breeze Fly, and the very hum of one of these insects is able to set a whole herd of cattle scampering off in every direction.

Even human beings are not exempt from the attacks of the Breeze Fly, as I can aver from much experience. Some years ago I was spending a week or two in the New Forest, and would have enjoyed it without alloy, had it not been for the Breeze Flies, which almost drove me out of the Forest. They seemed to detect me at a wonderful distance, and, with a loud,

fierce hum, as if sounding the charge, they would dart at me, and in a moment bury their lancets in the skin. So fierce were their assaults that they even pierced a stout coat of Scotch tweed and a flannel shirt, and, in spite of these protections, drew blood from my arms. For the first few days I was so persecuted by these insects that I hardly dared venture into the Forest, and was seriously considering whether I should not be obliged to go home again.

Their favourite point of attack was just behind the ear. There was no hope of resisting them, for they did not wait to settle, as reasonable flies might be expected to do, but drove straight at me with extended beaks, and buried their lancet-armed beak so deeply that each prick felt as if a stout needle had been run sharply into me. On returning to my lodging, after a few hours in the Forest, I have had the whole space behind my ears filled with clotted blood, my neck filled also with blood, my collar glued to my neck, and long tracks of blood running down my body and arms. The hands were served in just the same way, and, if I had not worn leather gauntleted gloves, and tied them at the wrists, I should scarcely have been able to move a finger.

At last I discovered a plan which enabled me to enjoy comparative immunity from these and other insect pests. Before starting into the Forest, I dipped a little sponge in paraffin and rubbed it well over my hands, face, and neck. I also put some of the liquid into the gloves, and took a little bottle with me, so that I might renew it as soon as the odour began to decrease in strength. Thus armed, I went into the Forest, and, hearing in the distance the well-known trumpet-charge of the Breeze Fly, determined to await its onset without flinching.

The creature drove fiercely at my face until it was within a foot or eighteen inches from me, when it came within the vapour of the paraffin, and darted off like an arrow. Two or three times it tried the assault, and as often had to check itself, until at last it flew off in disgust and did not return. After this glorious repulse of the enemy I never troubled myself about the flies, but used to amuse myself by hearing them in the distance, and then seeing them dart away, utterly discomfited with the novel odour. Of course, the smell of the

paraffin was not very agreeable to my own nostrils, but of the two evils it was infinitely the lesser, and I was only too glad to accept it.

On the frontispiece, Fig. 9, is a coloured portrait of the HUMBLE-BEE FLY (*Bombylius medius*), as it appears while on the wing.

This insect is an example of the Bombylidæ, a family in which the body is short and thick, with the wings extended horizontally on either side of the body. The proboscis is very long, and the thorax very convex. All the Bombylidæ fly with wonderful rapidity, and in many of their habits resemble the Humming-Bird Moth, which has already been described. Like that insect, the fly has a way of suddenly appearing as if by magic, and then disappearing as rapidly, its darting flight being as invisible as the track of a bullet through the air. Like the Humming-bird Moth, it feeds while on the wing, balancing itself at some little distance from a flower, plunging the end of its long proboscis into the nectary, and sucking out the sweet juices.

A warm spring day is the time in which the Humble-bee Fly may generally be seen. I have taken many of them in Bagley Wood, and found no great difficulty in catching them when their ways were learnt. It is useless to run after one of these insects, as the least movement will terrify it, and send it off far beyond the reach of the net. Whenever I wanted to catch a *Bombylius*, I used to look out for a patch of primroses on which the sun was shining, and to wait there with the net placed close to the flowers in readiness for a stroke. After waiting some little time, and taking care not to make the slightest movement, a *Bombylius* was nearly sure to come to the flowers, and hover first over one and then over another as if to ascertain which blossom contained the most honey. Having at last fixed upon a flower, it would plunge its proboscis into it, and then a quick stroke of the net would secure it before it had time to dart away.

PASSING by a considerable number of Flies, we come to the family Asilidæ. In this family, the body is long and the thorax narrowed in front. The wings have some perfect cells,

and the proboscis is stretched forward and about as long as the head. There are many of these insects, and as their habits are very similar we will take the present species as an example.

The GREAT HORNET FLY (*Asilus crabroniformis*) is shown on Woodcut LXXI. Fig. 1. Its colouring is simple, but exceedingly bold. The thorax is chrome-yellow, rather darker behind, and two blackish stripes run parallel to each other on the back. The basal half of the abdomen is velvet-black, and the rest bright chrome-yellow. The wings are yellow and so are the legs.

At a little distance this insect really looks very much like a hornet, and it has all the predacious habits of that insect. It is seldom seen without a fly or other insect in its grasp, the fore-legs clasping it firmly and the beak driven into the body of its victim. It is spread over the whole of England, but prefers sea-side downs and similar places. My own specimens were all taken on the great rolling chalk-downs of Wiltshire.

It has rather a peculiar mode of flight. It keeps near the ground, and there waits until it feels that it is in danger, when it rises and, with a sort of uncertain drifting movement, flies some ten or twelve yards, and then settles again. If followed up it is easily taken, as it soon appears to tire of these repeated flushings, and allows the pursuer to come quite close before it will move. This is by far the handsomest and most conspicuous of its family, all the others being comparatively dull. At Fig. *a* is shown the tarsus of this insect.

THE next family which comes before us is the large and important family of the Syrphidæ, popularly known as Hoverers, Hawk-flies, and Drone-Flies. In this family the head is hemispherical, and in the males the greater portion of it is occupied by the eyes. The antennæ are three-jointed, and bear a bristle, as seen at Fig. *c* on Woodcut LXXI. There are several perfect cells in the wings.

We shall take several examples of this large family, on account of the peculiar habits of their larvæ.

ON Woodcut LXXI. Fig. 4 is shown the common DRONE-FLY (*Eristalis tenax*), which is so plentiful in the summer time, and is so often taken for a bee on account of its form, colour,

large wings, and humming flight. Moreover, it has a bee-like habit of moving its abdomen up and down as if threatening to use a sting, and in consequence of this resemblance it is very needlessly dreaded by the generality of those who see it. Its colour is variable, but is generally some shades of brown, grey, and black. It is very swift on the wing, and has a quick darting flight much resembling that of the Humble-Bee Fly, which has just been described.

The larva is a most curious being. It is a worm-shaped grub, the tail of which is prolonged into a wonderfully long telescopic tube, by means of which the creature breathes, the air-tubes passing through it exactly as was related of the gnat larva. When this telescopic tail is prolonged to its greatest extent, it is about as thick as an ordinary pin. Owing to the transparency of its walls, the double air-tube within it can be easily seen, and when the tail is elongated so are the air-tubes. But when the larva is frightened and contracts its tail, the air-tubes may be seen doubled up in an apparently complicated but really simple manner, just below the base of the tail. As may be supposed, when a telescopic tail of more than two inches in length is suddenly shut up and reduced to a nullity, the elastic air-tubes within it must undergo a process of folding. This is done with such precision that the tail can be gradually extended or smartly closed over and over again, and yet not one single fold of the enclosed air-tubes ever hitches over another so as to impede the play of the all-important tubes.

This may appear a very simple matter, but it is in fact a very complicated one, as may be seen from the following parallel. Suppose that an ordinary telescope were drawn out to its fullest extent, and that two india-rubber tubes were stretched inside it, parallel to each other. Now if the telescope be closed, the tubes fall of necessity into coils in the lowest and largest joint of the telescope. Open the telescope again, and the two tubes will again be straight and parallel, provided that they have not interfered with each other while they were coiled up together at the bottom of the telescope. Let but one single coil envelope another, and either the telescopic joints cannot be opened, or one of the tubes is snapped.

I have dissected numbers of these larvæ, and have always

been impressed with the wonderful power and foresight displayed in this one point. Suppose that an *Eristalis* larva, or Rat-tailed Maggot as it is popularly called, be put into spirits of wine for the purpose of killing it, the tail at once contracts, so that no one who was not acquainted with the creature could recognise it. If, however, the tip of the tail be seized between the points of the forceps, and the organ be drawn out to its full extent, the air-tubes can be seen to unfold themselves with the most perfect accuracy. A hitch never occurs, but the coils, or rather the folds, open out one after the other, and the two convoluted tubes become straight and parallel.

This remarkable tail is rendered necessary on account of the habits of the larva which owns it. The creature lives in a manner which to us would be about as miserable as can be imagined. It passes the whole of its life immersed in thick and semi-putrid mud, with its head downwards. The mud cannot be too thick, too black, or too noisome for this larva. There was one place where I could procure as many Rat-tailed larvæ as I liked. Just under the eaves of a church roof a large tub had been sunk in the ground, for the purpose of catching the rain-water. Year after year it had been neglected, and it had become two-thirds full of a horribly fetid mud, composed of dead leaves, worms that had crawled over the edge of the tub and fallen into the water, frogs and toads that had foolishly jumped into the tub, forgetting that they could not jump out again, quantities of moths, beetles, and other insects that had inadvertently fallen into the water and been drowned, field-mice that had overbalanced themselves in trying to drink, and other substances too numerous to mention.

The state of such a mud can easily be imagined, and yet this horrible compound was in its way a Paradise to vast numbers of Rat-tailed Maggots, which were busily employed in their beneficent task of transmuting death into life, and of devouring this poisonous and mephitic mud, so that it might be changed into bright and active flies. Such is indeed the task of these and many other insects, and it is absolutely impossible to exaggerate the debt of gratitude which we owe them. Every Drone-Fly which we see is a living proof that a certain amount of pestilential matter has been consumed and rendered harmless, and it is evident that such insects ought to be encouraged

and protected in every mode that lies in the power of civilised man.

To return for a moment to our larva. It is impossible that any creature could obtain air while buried in the thick mud which has just been described. There are many creatures, especially crustacea, which do live buried in mud, but then they always form a slight tunnel, so that they are really immersed, not in mud, but in water. The Rat-tailed Maggot, however, is really buried in the mud, and needs some apparatus for communicating with the air. This apparatus is supplied by the telescopic tail of the larva, which can be projected out of the mud, and by means of the double air-tubes which it contains conveys the necessary amount of oxygen to the system.

The 'tail' can be retracted with great rapidity. I had a great number of the larvæ in a bottle, on the bottom of which was placed a layer of mud in which the creatures could bury themselves, and the rest of the bottle nearly filled with water. When all was quiet, all the tails remained quite upright, and looked like a number of young aquatic plants. But if the slightest jar were given to the bottle, all the tails were retracted, and the water was left clear and empty as if by a conjuring trick.

When the larva is full-fed on the disgusting substances which form its dainties, it extricates itself from the mud by means of seven pairs of tiny hooked feet, crawls ashore, buries itself in the earth, and there awaits its change. The larval skin then shortens and hardens, and the pupa separates itself from its former skin, which then acts the part of a cocoon. In process of time the transformation is complete, and the dull motionless grub that had passed its whole life sunk in the dark and obscene mud is transformed into a creature of light, gifted with enormous eyes and glittering powerful wings, and darting through the air with a rapidity so great that the eye cannot follow its track. The specific name of *tenax* is given to the insect on account of the tenacity with which it holds to any object that it may grasp with its feet.

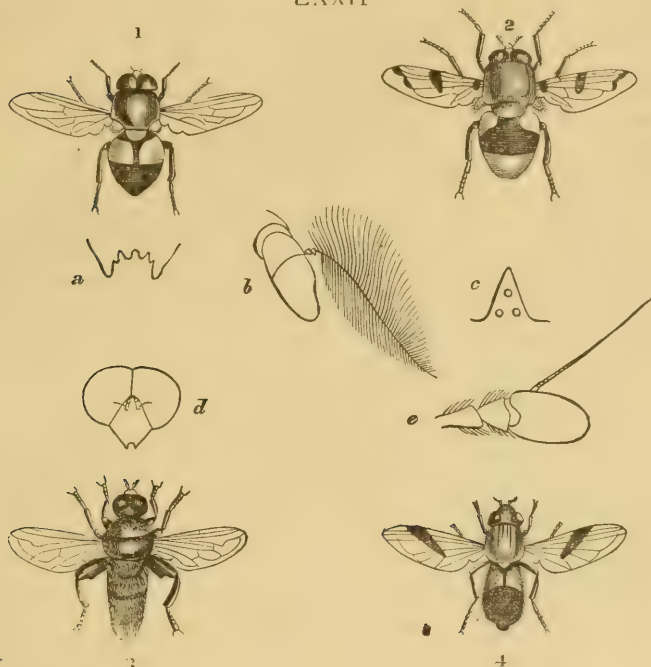
ON Woodcut LXXII. Fig. 3 is represented an insect called *Merodon clavipes*.

In this genus the body is blunt and hairy, the third joint of

the antennæ is oval, and the thighs of the hind legs have a strong tooth at their tips. The generic name *Merodon* refers to this structure, signifying literally 'thigh-toothed,' and the specific name of *clavipes*, or club-footed, alludes to the thickened and club-like form of the hind leg.

This is rather a pretty insect. The thorax is shining black, with grey hair at the sides, and the abdomen is black, adorned

LXXII



1. *Volucella pellucens*. 2. *Volucella plumata*. 3. *Merodon clavipes*. 4. *Syrphus lucorum*.
a. *Volucella pellucens*, clypeus. *b.* Do., antenna. *c.* Do., ocelli. *d.* Do., front of head.
e. *Syrphus lucorum*, antenna.

with a covering of rich golden hairs. There is also a tuft of golden hair at the base of the antennæ. The larva feeds on the bulb of the narcissus, into which it burrows, and devours the inside. It is rather an odd and clumsy-looking grub, shaped much like a rolling-pin, and covered with successive rings of hair. The mouth has two scaly hooks, and immediately above them are two short, forked horns.

ON Woodcut LXXII. Fig. 1 is shown one of our most curious insects, called *Volucella pellucens*.

It is impossible for a mere woodcut to represent the very peculiar structure of this creature. In the illustration, the two large white patches on the abdomen look as if they were merely white and opaque, whereas, in reality, they are almost as translucent as if made of glass. Indeed the whole upper part of the abdomen seems as if it were made of very transparent horn, the only opaque portion being the dark stripe down the centre. Like the generality of its family, the insect is very swift-winged, and has a quick, darting flight, which makes its capture a work of some difficulty. I have taken plenty of specimens in Bagley Wood, waiting for them as they balanced themselves near flowers, and then capturing them with a smart stroke of the net.

The larva of the *Volucella* is parasitic on the nests of social hymenoptera. I have often obtained these larvæ from the nests of humble-bees, and always thought that they restricted themselves to these bees. Mr. S. Stone, however, found that the common wasp was also favoured with the presence of these parasites. In his description of sundry wasp-nests, published in the 'Zoologist,' p. 9452, he writes the following remarks:— 'Upon the crown of almost every nest (of *Vespa vulgaris*) I examined, after the season had become advanced, I found eggs of *Volucella*, and my attention was in several instances drawn to a nest by seeing a specimen of *Volucella pellucens* or of *Volucella bombylans* hang about or alight near the entrance to it.'

These larvæ are most extraordinary-looking beings. Supposing a rolling-pin to be cut in two transversely in the middle, each half will accurately resemble the *Volucella* larva. The small end of this larva is the head, which is furnished with a pair of double-toothed mandibles and six little tentacles; and the large and bluntly-truncated end is the tail, around the circumference of which are planted six soft radiating tentacles. The whole of the body is thickly covered with transverse wrinkles, and along the sides is a row of five points. At Fig. *a* is shown the curiously notched clypeus of this insect. At Fig. *b* one of the antennæ is drawn, so as to show the bold double-feathering with which the bristle of the antennæ is adorned; and at Fig. *c* the front of the head is drawn, for the

purpose of showing the enormous eyes of the insect, and the space which they occupy in the head. The ocelli, or simple eyes, are shown at Fig. c.

ON the same Woodcut, Fig. 2, is shown another species, called *Volucella plumata*, so called because the bristle of the antennæ is so strongly feathered that it is quite conspicuous even to the naked eye. It looks very much like a humble-bee, and indeed, so closely resembles a worker humble-bee, that no one who was not an entomologist would think that it could be any other insect. The thorax is shining black, and has a quantity of golden-yellow hair on the sides. The thorax is also black, with yellow hair on the base, and grey hair at the end.

This species haunts the nests of humble-bees, and probably, owing to the bee-like aspect of the insect, mixes freely with the bees and passes in and out of the nest without challenge. I have often taken them near the nests of humble-bees, and, in consequence of the remarkable similitude of the insects, at first allowed the Flies to escape, taking them for bees. Indeed, in the first instance, it was only the difference of flight that betrayed the parasite.

AT Fig. 4 of Woodcut LXXII. is drawn an insect belonging to the typical genus. Its name is *Syrphus lucorum*.

The word *Syrphus* is Greek, and is given under a remarkable variety of forms, being indifferently spelt as *Serphos*, *Sterphos*, or *Seriphos*. It is used to designate some small winged insect, but that the word is not rightly applied to the present group of insects is evident from the fact that an old Greek proverb alludes to the *Syrphus* as possessing a sting.

In these insects the third joint of the antennæ is oval, the abdomen is elliptic and depressed, the legs are slender, and the tarsi simple in both sexes, whereas in some genera the front tarsi of the males are flattened and widened. They are popularly known as Hawk-flies.

This species is rather a pretty insect. Its general colour is black. The thorax is clothed with rich, warm-brown hairs, and the base of the abdomen with golden down. It is slightly variable in the colour and extent of its markings, and in some specimens there is a brown patch on the base of the abdomen.

The larva of the *Syrphus* is predacious, and feeds upon the aphides; so that every *Syrphus* that is seen in the garden ought to be protected as an inestimable friend to the gardener. In shape it very much resembles the *Volucella* larva which has just been described, the grub being small and tapering at the head, and wide and blunt at the tail. When the female *Syrphus* is engaged in the great work of oviposition, she looks out for the leaves or twigs which are most thickly beset with aphides, and deposits an egg among them, never putting two eggs near each other. As soon as it is hatched, the young *Syrphus* larva finds itself in the midst of its food, and straightway takes advantage of the position in which it is placed. Clinging to the leaf with the projections on its under surface, the larva stretches out the fore part of the body, and, with a curious apparatus belonging to its mouth, seizes on an aphid. It then pulls the aphid from its hold on the leaf or twig, and holds it aloft, so that the struggles of its prey are quite useless, and in this position sucks the juices. A very few minutes suffice for this operation, and it then throws away the emptied skin of the unfortunate aphid, and waits until another comes in its way.

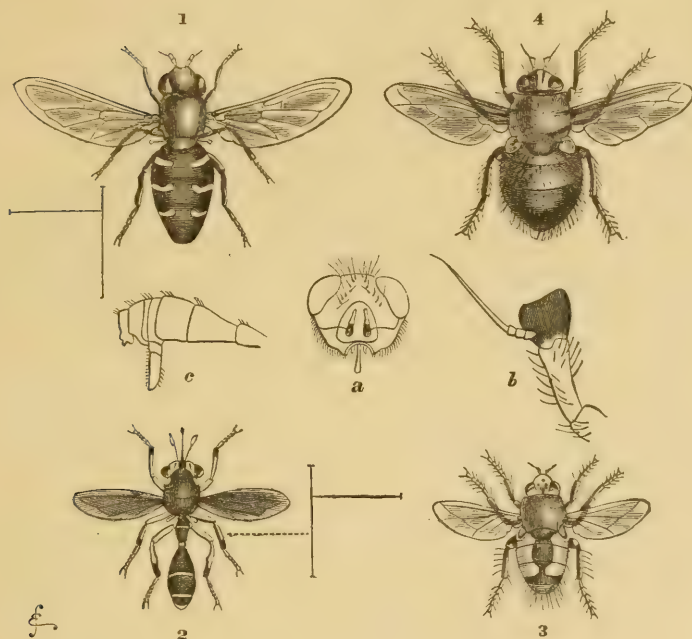
When full-fed, the *Syrphus* larva fixes its tail very firmly to the plant on which it has been living, attaching it by means of a sort of glue or cement. The whole of the body then contracts, and the pupa is developed within the larval skin, which acts the part of a cocoon. It is a curious fact that when this change takes place, the creature exactly reverses its shape, the thick, blunt tail being contracted nearly into a point, while the slender, attenuated fore part of the body becomes thick and blunt. Before many days have elapsed, the fly is fully developed, pushes strongly against the end of its habitation, forces off the end with its head, and emerges upon the world.

ANOTHER species of these insects, *Syrphus* or *Scæva pyrastris*, is shown on Woodcut LXXIII. Fig. 1. This fine insect is blackish-blue, on which is a whitish-grey down. The thorax is very shining, and on each side of the abdomen are three short bands, varying from pure white to golden yellow. In some few species the bands are absent. The larva may be found feeding on the aphides of the rose-tree.

All the Hawk-flies are extremely variable in their numbers, sometimes being very scarce, while at other times they appear in swarms. There is a notice in the 'Entomologist,' vol. iv. page 357, by Mr. C. Horne, in which the numbers of these insects are mentioned.

'At Margate, on August 24, 1869, there came a great number of these insects, so as to attract the notice of all

LZZIII



1. *Syrphus* (or *Scæva*) *pyrastris*.
4. *Tachina grossa*. a. Do., head.
of male.

2. *Conops macrocephalus*. 3. *Tachina ferox*.
b. Do., antenna. c. *Conops macrocephalus*, abdomen

visitors. Many specimens were taken, among which I have identified *Syrphus balteatus*, *S. decorus*, *S. tæniatus*, *S. topiarius*, and *Eristalis tenax*. The wind was then blowing from the east, and it was very hot weather. The pier at Ramsgate on the same day was almost covered with them, and everyone said that they came from the Channel. After this the wind was from inland, but it was too fresh and breezy for many to

remain; and they had become so scarce in the month of September, that with difficulty seven or eight specimens were procured.

‘The servant at one of the houses in Clifton Terrace, Margate, says that she had to go to all the windows with a dust-pan and brush, to take them away from the window-ledge; and I have been given to understand that it was the same in most of the houses at the place. They went by strange names, but the most common one was that of “horse-stingers,” from their appearance.

‘You have already noticed flights of this class of insects in the “Zoologist;” and Mr. F. Smith, of the British Museum, tells me that he saw, some years since, the line of surf on the beach for miles covered with the dead bodies of *Syrphus pyrastris*, so that they might have been taken up by shovels-full. This was at Bournemouth, and the insects had been drowned in the sea, and their remains thus cast ashore. The same thing, he tells me, was observed to occur at the back of the Isle of Wight, which is not far off. Hence these flights would appear to be not uncommon, although when they do occur they are worthy of note.’

THE next family is that of the Conopidæ, which are represented by a very pretty insect, called *Conops vesicularis*, which is shown on Plate XX. Fig. 2.

In all the Conopidæ the proboscis is always long and projecting, elbowed, and siphon-shaped; while it varies in form from conical and cylindrical to thread-like. In this organ both the mandibles and the lancet which represent the maxillæ are absent, and only those portions remain which represent the upper lip and tongue; so that all the Conopidæ are perfectly harmless, and cannot even prey upon other insects.

This species bears the most extraordinary resemblance to the solitary wasps belonging to the genus *Odynerus*. The thorax of this insect is black, and the base of the abdomen is orange, the remainder being black and yellow, arranged as shown in the illustration. The wings are transparent, and are clouded with brown.

In its larval state this is one of the many parasitic insects, living in the interior of the humble-bee. Like the *Stylops*, which has already been described in the course of this work,



PLATE XX.

DIPTERA.

1. *Tabanus bovinus*.
2. *Conops vesicularis*.
3. *Gasterophilus equi*
4. *Tachina grossa*.

PLANT:—

Honeysuckle.



it undergoes all its transformations within the body of the living bee, and then forces its way into the world between the segments of the insect in which it had lived. Latreille reared four of these curious flies from humble-bees which he had placed in a box.

There are several species of *Conops*, all prettily coloured. There is, for example, *Conops flavipes*, a smaller and slighter insect than the preceding species, velvet-black in colour, banded with bright golden yellow. Then there is *Conops rufipes*, which is coloured exactly like the hornet, the thorax being reddish-brown and the abdomen yellow, banded with dark brown. Another species, *Conops macrocephalus*, is shown on Woodcut LXXIII. Fig. 2, and the curious abdomen of the male insect is drawn at Fig. c. The specific name *macrocephalus* signifies long-headed, and is given to the insect in consequence of the shape of the head, which is wider than the thorax.

This is a pretty and not common insect. The general colour is black, and there is a coating of short ashen hairs. The face is yellow, the antennæ rust-red, and upon the shoulder of the thorax there is a spot of silvery white. The wings are yellowish, darkening into brown on the costal margin. The abdomen is black, the margin of each segment is yellow, with a silvery gloss. The legs are reddish, and the base of the thighs dark brown. The insect may be found upon flowers.

The generic name *Conops* is clearly a wrong one, and calculated to mislead anyone who is something of a classical scholar and little of an entomologist. The word is Greek, signifying a gnat, and has been incorporated in our language in the well-known word 'canopy,' i.e., a gnat-curtain, that being the real meaning of the word. Herodotus employs the word *Conops* when describing the gnats or mosquitos which infest the marshy lands on the banks of the Nile, and the method employed by the fishermen in guarding themselves from the attacks of these troublesome insects.

WE now come to the enormous family of the Muscidæ, a family which may rank with the ichneumon-flies, the Noctuæ and Tineæ Moths, and the Rove-beetles, as tests of an entomologist's temper and patience. It is hardly possible to imagine anything more trying to the entomologist than to have half a

dozen large boxes of Muscidæ placed before him, with instructions to find out their names, and to marshal them in their right places. The task really seems to be a hopeless one, and life to be too short for accomplishing it, more especially as there are sure to be some hitherto undescribed species, and they are equally sure to come first to hand, as if for the express purpose of making the unfortunate entomologist hunt for their description in vain. At least a thousand species of Muscidæ are known to inhabit England, and it is probable that twice that number may be yet discovered and named.

Fortunately, there is no difficulty in deciding whether a fly belongs to this family or not, as a glance at the proboscis will at once determine its place. This organ is short and membranous, and terminated by two large lobes, the structure of which will be briefly described in the course of the following pages. None of the Muscidæ are of any great size, the ordinary house-fly being of about the average dimensions.

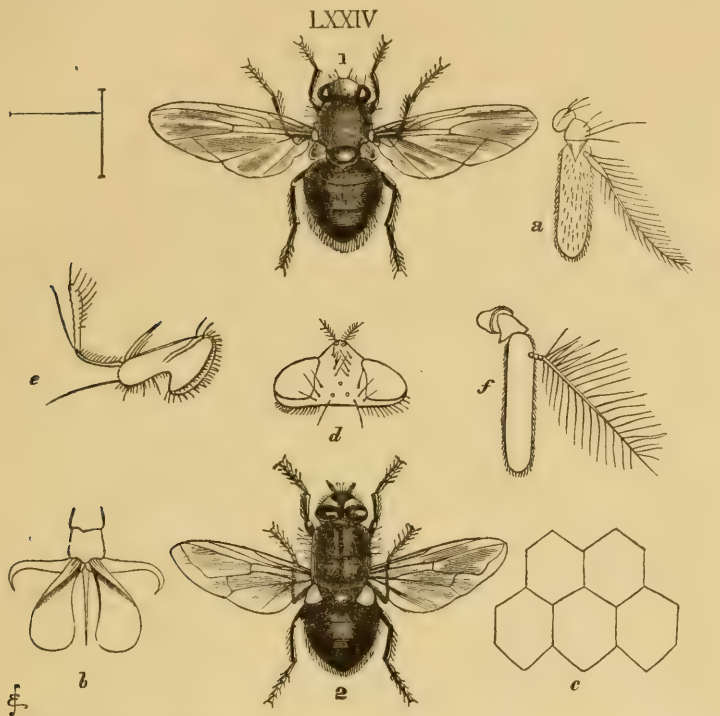
WITHOUT going further into detail, we will begin with the insect which is represented on Woodcut LXXIII. Fig. 3, and which is called *Tachina feroæ*.

In some respects this insect resembles the ichneumon-flies which have been already described. The female lays her eggs upon the bodies of various caterpillars, and the young larvæ, as soon as they are hatched, penetrate into the body of the caterpillar, and feed upon the fatty substance which was intended to be the subsistence of the insect during its pupal stage of existence. One naturalist reared as many as eighty specimens of *Tachina* from a single caterpillar of the Death's-head Moth. Not only the Lepidoptera, but other orders of insects, are subject to the attacks of these flies, for they have been ascertained to inhabit the larvæ of various Coleoptera, Hymenoptera, and even the bodies of spiders.

The present species has its head tinged with grey, and chestnut hairs on either side. The abdomen is yellowish, and shining as if made of horn, and is black along the middle, and slightly clothed with stiff hairs. The wings are transparent, and tend to yellow towards the base.

THE largest of these insects is that which is drawn on Woodcut LXXIII. Fig. 4. It is called *Tachina grossa*, and is so

large and hairy that it looks very much like a black humble-bee. The general colour of this insect is black, but there is some yellow hair on the face and sides. The very peculiar antenna is shown at Fig. *b*, and the front of the head at Fig. *a*. Altogether no less than one hundred and sixty-six species of *Tachina* have been discovered in this country, and described; and, in all probability, many more remain to be discovered.



1. *Musca* or *Anthomyia lardaria*, female. a. Do., antenna. b. Do., foot.
 c. Do., facets of eye. 2. *Musca chloris*, male. d. *Musca chloris*, head of female.
 e. Do., tongue. f. Do., antenna.

Another figure of *Tachina grossa* is given on Plate XX. Fig. 4.

ON Woodcut LXXIV. Fig. 1 is shown an insect called the MEAT-FLY (*Musca Anthomyia* or *Aricia lardaria*). In this genus the bristle of the antennæ is feathered, the abdomen is oval and bristly, and the alulets are large. The colour of

this species is blue-black, and the head is gilded above and in front. The eyes are hairy, there are four longitudinal black stripes on the thorax, and the whole of the body is sparingly covered with very short greyish down.

There are many species of this genus, the larvæ of which undergo their transformation in various substances, both animal and vegetable. These substances are generally in a more or less decaying state, but there are some species which make their larval home in the roots of different plants, the radish and the onion being particularly favoured by them.

The last-mentioned insect, *Anthomyia ceparum*, lays her eggs close to the ground, sheltered by the leaf-sheath. Thus protected, the larva is soon hatched, burrows downwards into the very heart of the bulb, and very effectually destroys it. Then there is the LETTUCE-FLY (*Anthomyia lactuæ*), which burrows into the heart of the lettuce, as it is tied up for the purpose of blanching the leaves; and the CABBAGE-FLY (*Anthomyia brassicæ*), which performs a similar task with regard to the cabbage, choosing for its depredations the junction of the stem and leaves.

THE second species on Woodcut LXXIV. is called *Musca chloris*, and the two are introduced so as to show the construction of the most conspicuous parts of these insects.

On account of its colour, this insect is sometimes called the GREEN-BOTTLE, in contradistinction to the Blue-bottle. Its colour is bright shining green, slightly inclining to blue, or taking a golden gloss. There is a black stripe upon the crown of the head. The eyes are brownish-red, and are divided in the female by a broad band, and in the males by a narrow one. The name *chloris* is Greek, and signifies green. The insect is tolerably common, and is very active and quick on the wing, so that it is not easily caught.

Fig. *a* shows the antenna of *Anthomyia*, the very long and almost cylindrical third joint being armed with a feathered bristle. Fig. *c* shows in outline five of the facets which go to make up the compound eye of the insect. If dissected, this is shown to be a very wonderful structure, each of the facets being then seen to be the termination of a separate eye. Every one of these facets is set, so to speak, in a frame, which is, for the most part, hexagonal, like a honeycomb, but at the

edges becomes either pentagonal or even square. It consists of a conical transparent body, called the cone, which is set in a layer of dark red pigment. If a fly be crushed, this pigment escapes, and looks just like blood. Then follows the 'rod,' a delicate fibre which connects the cone with nerve-centres in the head.

The whole of this structure has been thoroughly worked out by Mr. B. T. Lowne in his valuable monograph on 'The Anatomy and Physiology of the Blow-Fly,' a work which every entomologist ought to possess, as the information which it gives does not merely relate to the particular insect of which the author treats, but explains the structure of various other insects. Having myself dissected great numbers of Blow-Flies, I am qualified to express an opinion on the subject, and to appreciate the careful pains and labour that the author has bestowed upon his investigations.

At Fig. *b* is given an outline drawing of the foot, with its two pads. The structure of this member has already been described, so that we need not refer to it again. At Fig. *e* is given a side view of the proboscis, showing its right lobe. This instrument forms a most beautiful object in the microscope. The two lobes are then seen to be traversed by a number of air-tubes of a rather peculiar structure, all radiating from two principal tubes, one to each lobe.

Generally the air-tubes or tracheæ of insects are kept in shape by a spiral thread between the two layers of which they are composed, but in the air-tubes of the proboscis the place of the spiral thread is taken by a number of incomplete rings, called false tracheæ. These incomplete rings look something like the ancient torque, or, to speak more familiarly, like a horse-shoe. The open part of each ring is downward, and the result of this structure is that they form a sort of strainer through which the liquid portions of their food are passed. The shape of this curious organ is greatly varied, and although the proboscis of every Fly agrees in the principles of its construction, there are not any two species which have it exactly alike.

At Fig. 1 of Woodcut LXXV. is shown the common HOUSE-FLY (*Musca domestica*), slightly magnified. In all the insects belonging to this genus, the transformation is conducted in

much the same manner. When the larva is full-fed, the skin hardens into an oval cocoon, and the pupa is thus developed within its original larval skin.

To this enormous group belongs the BLOW-FLY or BLUE-BOTTLE (*Musca vomitoria*), which is so very familiar in our houses, and is so apt to deposit its eggs upon meat that even approaches decomposition. Here I may mention that the oval meat-safes, like dish-covers, which are so largely sold for the purpose of keeping the Blow-Flies from the meat, do entirely exclude the Flies, but they do not exclude the eggs, so that the cook who has covered the meat carefully with one of these safes, often finds that, in spite of her precautions, the meat is as 'fly-blown' as if it had been totally exposed to the Blue-bottles. The fact is, when the mother insect finds that she cannot gain actual access to the meat, she goes to the top of the cover, and lets her eggs drop through the meshes of the wire gauze.

Then there is another insect, popularly called the FLESH-FLY or the BAKER (*Musca* or *Sarcophaga carnaria*), which proceeds in a different and more expeditious way. With the Blue-bottle the eggs have to be hatched after they are deposited, but with the Flesh-Fly they are deposited as maggots, being hatched within the body of the parent. If the female be dissected before she has deposited her young, a most curious spectacle is disclosed. The abdomen is almost entirely filled with two white rolls, like riband, and when these rolls are examined with the microscope, they are seen to consist of a vast number of tiny maggots, placed side by side in perfect order. Each of these rolls contains from eight to ten thousand larvæ; and the reader may easily imagine how rapid is the demolition of the substances on which one of these Flies deposits her multitudinous young.

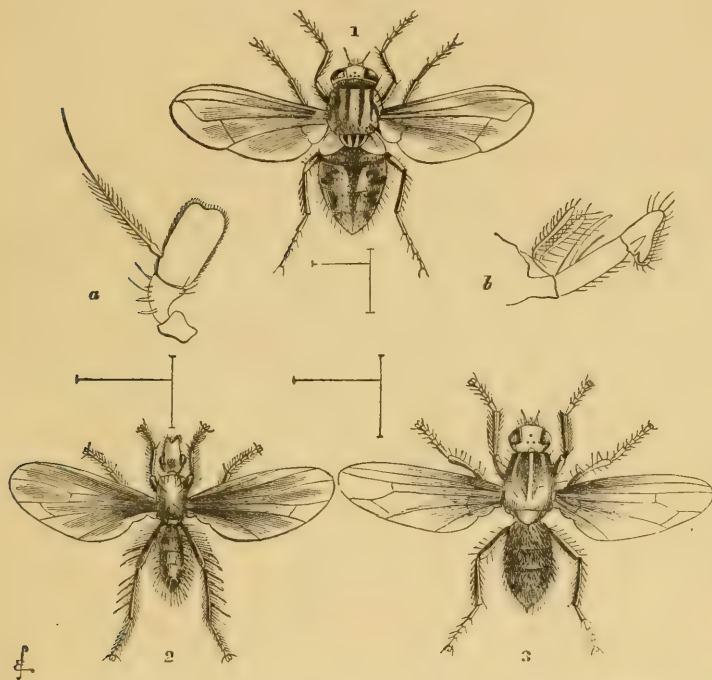
It was to this species that Linnæus referred when he wrote the apparent paradox that three Flies could eat an ox as fast as a lion. The Fly does not even wait for decomposition, or at all events can detect incipient decomposition long before it is apparent to the human senses; for I have often found that if a recently-killed mouse or bird be allowed to lie in any exposed place for an hour or two, vast numbers of these tiny larvæ will be deposited upon it, the mother Fly having taken the precaution to place them under the wings, in the mouth, at the

junction of the legs with the body, or, if the creature be lying on the ground, upon the surface of the body that is next to the earth.

This is not the only Fly that deposits its young in this curious manner, but I have selected the best known species as an example of the group.

ON Woodcut LXXV., at Figs. 2 and 3, are shown two species of the well-known Dung-Flies, of which the common

LXXV.

1. *Musca domestica*.2. *Scatophaga scybalaria*.3. *Scatophaga stercoraria*.a. *Scatophaga scybalaria*, antenna.

b. Do., tongue.

COW-DUNG FLY (*Scatophaga stercoraria*) is the most plentiful. In this genus the last joint of the antenna is rather long, the head is spherical, and the body covered with stiff hairs. These Flies may always be found in fields frequented by cows, as it is upon the dung of these animals that the larvæ are fed.

The most remarkable point in the economy of these insects is the development of the egg. It is necessary for the due

hatching of the young that the egg should be kept in a state of moisture as well as warmth, and this point is secured by depositing the egg in the recent cow-dung. This, however, is not all. If the egg becomes dry, it shrivels up and the young maggot is never hatched, while, if it should sink entirely, it is drowned, so to speak, the egg requiring air as well as moisture.

This object is attained in a very simple but effective manner. The egg is shaped something like that of the domestic fowl, being larger at one end than at the other. At the large end, two horn-like appendages project from the egg and diverge from each other, their roots being about one-third of the length of the egg from the upper part, so that the egg cannot sink deeper than the horns. When the time comes for the hatching of the larva, the egg opens at the wide end, and the young grub escapes through the opening. These eggs may be found in plenty, more than a hundred being stuck into a space scarcely wider than a man's hand. The larva is conical in shape, the head being at the apex of the cone, and the broadest or tail end being armed with a number of little fleshy points.

The common yellow Cow-dung Fly is too well known to need description. The other species, *Scatophaga scybalaria*, which is shown at Fig. 2, is orange-ochreous in colour, but through the soft yellow hair a number of black bristles protrude. The thorax and scutellum are brownish, and the first segment of the abdomen is ashen-grey. The wings are slightly iridescent and brown, inclining to orange on the costal margin. The tips of the thighs of the hind legs are black.

ON Woodcut LXXVI. Fig. 1 is a magnified representation of a little Fly called *Phora abdominalis*. In this genus the third joint of the antennæ, instead of being long and nearly cylindrical, is almost spherical. The margin of the wings is fringed. The name of *abdominalis* is given to this species on account of the form of the abdomen, which is broad at the base and tapers rapidly to the tip. One of the hind legs is shown at Fig. b, and a profile view of the head is given at Fig. a.

The colour of this species is glossy black, and the head is irregularly and coarsely punctured. The palpi are orange. The thorax is downy, the abdomen rust-red, and the wings

yellowish, with brown nervures. Some of these insects were hatched from larvæ found attached to the pupæ of ladybirds.

The larvæ of these Flies are found to feed on various substances, some being believed to be parasitic on other larvæ, and others having been observed to feed on vegetable substances. For example, the larva of one species, *Phora dauci*,



1. *Phora abdominalis*. 2. *Ornithomyia fringillaria*. a. *Phora abdominalis*: head, side view. b. Do., leg. c. *Ornithomyia fringillaria*, leg. d. Do., maxilla.

was seen to feed upon the interior of decaying radish-roots. The larva is nearly cylindrical in shape, but is slightly narrowed in front. The last segment of the body has eight radiating points, like those of the one or two larvæ which have been described, and there are also two spiracles on the same segment.

WE now come to the small but important family of the *Cæstridæ*, popularly known as Bot-Flies. In these insects the

parts of the mouth are quite undeveloped, the whole of the structures being represented by two or three little tubercles. In the perfect state, therefore, these Flies are quite harmless, but in their larval condition they are hurtful to various animals. In fact, all our cattle are attacked by these insects, which are parasitic upon or in them, and not even the thick-skinned camel and rhinoceros are exempt from them.

One of these insects, the common BOT-FLY (*Gasterophilus equi*) is shown on Plate XX. Fig. 3. Its life history is briefly as follows:—

The mother insect flies about a horse, and with its ovipositor places an egg on the hair of some part which the horse is sure to lick. The egg is thus taken up by the tongue and conveyed into the stomach, where it is hatched. The larva then attaches itself to the inner membrane of the stomach, and appears to feed upon the secretions.

The number of these larvæ which will inhabit the stomach of the horse is really wonderful. I have seen the interior of that organ so covered with them that the surface of the stomach was completely hidden by their depending bodies. In form they are nearly cylindrical, but the body is suddenly narrowed towards the head, which is armed with a number of little hooks, by which the grub attaches itself to the interior of the stomach. They remain within the stomach of the horse throughout the winter, and in the spring they are full-fed and loosen their hold of the stomach. They are then carried through the intestines and fall to the ground, into which they at once burrow and there assume their pupal form. The process of transformation lasts about three weeks, and at the expiration of that time the perfect fly appears.

Opinions are greatly divided as to the effect produced on the horse by these larvæ. Some of our best authorities, Mr. Youatt among the number, believe that they do no harm, while some go so far as to think that their presence is beneficial. I cannot but think, however, that as these larvæ derive all their nourishment from substances within the stomach of the horse, they must abstract a corresponding amount from the nourishment of the horse, and that, whether they cause inconvenience or not to the animal, their presence must be in some way hurtful to it.

The generic name *Gasterophilus* is formed from two Greek words, and signifies 'belly-loving.' It has been given to the insect in consequence of the habits of the larvæ. It is rather a pretty insect, and has some resemblance to an *Andrena*. The thorax is black, partly covered with warm chestnut down, and the abdomen is alternately banded with ruddy chestnut and black. The wings are slightly clouded with brown.

THERE are several other insects belonging to this family, each of which selects some particular animal for its home.

There is, for example, the WURBLE BREEZE-FLY, or GAD-FLY (*Æstrus bovis*), the economy of which is very remarkable, the creature seeming to produce much the same effect upon the ox that the gall-flies do upon plants. Instead of being taken into the stomach of the animal, as is the case with the last-mentioned species, this species never penetrates further than the skin.

Into the skin the larva burrows as soon as hatched, and it is remarkable that the female insect takes as much care to place the egg on the back where the tongue of the ox cannot reach it, as the Bot-fly to place the egg where the tongue of the horse has easy access to it. Beneath, or rather in, the thickness of the skin, the larva makes its residence, its head being downwards and its wide tail upwards, so as to receive air into the two spiracles which are there placed. The habitation of the Wurble, as the grub is called, is made evident by a small swelling, in the upper part of which is an opening through which the tail end of the larva can be seen.

When it is full-fed, the larva retrogrades out of its habitation and falls to the earth. No sooner is it fairly on the ground than it begins to burrow, and then undergoes its transformations underground, exactly as has been stated of the Bot-fly. The colour of this species is brownish, the base of the abdomen is covered with grey down, and the rest is ruddy chestnut.

THEN there is the SHEEP-FLY (*Æstrus ovis*), a smaller, greyer, and more slender species. The female of this insect selects the nostril of the sheep as the place whereon she is about to deposit her eggs. The sheep are very much afraid of this insect, and do all in their power to rid themselves of their

enemy, rubbing their noses against the ground, shaking their heads, and rushing about in all directions. Their exertions are, however, useless. Sooner or later, the fly succeeds in depositing her eggs just inside the nostril, and there leaves them. They are soon hatched, and then the young larva, which is furnished with hooked appendages to its head, crawls up the nostril, and fixes itself in the frontal sinus. Its life then much resembles that of the other insects of the family.

Antelopes are known to be specially subject to the attacks of the Gad Fly, and all African hunters say that the head of the gnu is never found to be without at least one Gad Fly grub in the frontal sinus.

WE now come to the last great division of the Diptera, the THORACOCEPHALA, or those insects whose heads are sunk in the thorax. Like the preceding insects, they are all parasitic, but they differ in many points from them. In the first place, there is the position of the head, to which reference has just been made, and besides, the antennæ are differently arranged, and the mode of transformation is different. In consequence of these peculiarities, it has been thought by several eminent entomologists that these insects ought not to be ranked with the Diptera, but to be constituted into a separate order, to which the name of Homaloptera was given. It has now, however, been decided that they really are Diptera, though they form a very divergent branch of that great order.

They are divided into two families, the first of which is named Hippoboscidæ. This term is composed of two Greek words, the former signifying a horse, and the latter, to feed upon. How thoroughly appropriate is the word, anyone can tell who has driven or ridden a horse when the Flies are about. They are very active on foot, and can run sideways as fast as they can forward, burying themselves among the hair or feathers of the creature which they attack. In some of the insects the wings are entirely wanting, as is the case with the very common SHEEP-TICK (*Melophagus ovinus*). I need scarcely say that the name is entirely a wrong one, inasmuch as the Sheep-tick is an insect, and the true ticks belong to quite a different class of beings. This, being very plentiful, will serve as an excellent example of the Hippoboscidæ. It

can be found without difficulty upon almost any sheep; but to get it away without damaging it is not a very easy task, the hooked and powerful legs grasping the wool as if with six pairs of pincers, and the insect pushing its way deeper and deeper in the fleece as it thinks itself in danger. While thus engaged in evading the pursuer, the Sheep-tick looks so very much like a spider that the French call it the Spider Fly.

The whole structure of the head and beak of this insect is very remarkable, and it is not very easy to trace the analysis of the various parts of the mouth. If one of these insects be examined with a microscope, the front of the head is seen to be furnished with two rather long, curved, pointed, horny plates, covered with bristles, between which lie the setæ or piercing organs. Mr. Westwood thinks that these instruments are intended for the purpose of pushing away the hair of the animal on which the Fly is feeding, so that the setæ may penetrate the more deeply into the skin.

It is evident that these projecting horny processes would be very much in the way of the Sheep-tick when it travels to and fro through the wool. If, however, the insect be turned over, so that the under surface can be seen, the mode in which this difficulty is overcome is at once evident. On the under surface of the thorax there is a deep pit, extending beyond the fore-legs as far as the base of the middle pair of legs. When the head is bent downwards, the two horny projections, together with the piercing and sucking apparatus of the mouth, are sunk completely into the pit, so that nothing is presented to the wool but a perfectly smooth and shining surface which can easily glide between the fibres.

The colour of the Sheep-tick is yellow-brown, and the thorax and limbs are polished and granulated. The legs are remarkably strong, and the claws are jet-black and shining. In shape they very much resemble the incurved claws of the sloth, and the analogy between them is carried out in their action as well as in their form. Just as the hooked claws of the sloth enable it to move with great activity among the branches, swinging itself from bough to bough as easily as does a monkey, so do the similar claws of the Sheep-tick enable the insect to traverse the thick wool, among the fibres of

which it travels with a rapidity that seems scarcely possible in such a locality.

I never saw a sloth on a level or smooth surface, but it is well-known that the long and curved claws which are so useful among the branches, are absolutely impediments when the creature is on flat and hard ground on which its claws have no hold. Similarly, I find that whereas the common Flies can move about actively enough on glass, even though it be upright, the Sheep-tick is quite at a loss when placed on a plate or any similarly smooth substance. Under such circumstances it moves its legs with great rapidity, but does not succeed in making much progress, and the unwonted effect of its exertions seems to throw it into quite a fever of fright and anxiety.

This is one of the wingless species. It is so completely without wings that even the practised eye of the entomologist, aided by the microscope, can hardly detect the undeveloped rudiments of these organs. The insect, indeed, seems to be nothing but legs and abdomen, the latter being nearly flat and round, this shape being intended to serve a purpose which will presently be described.

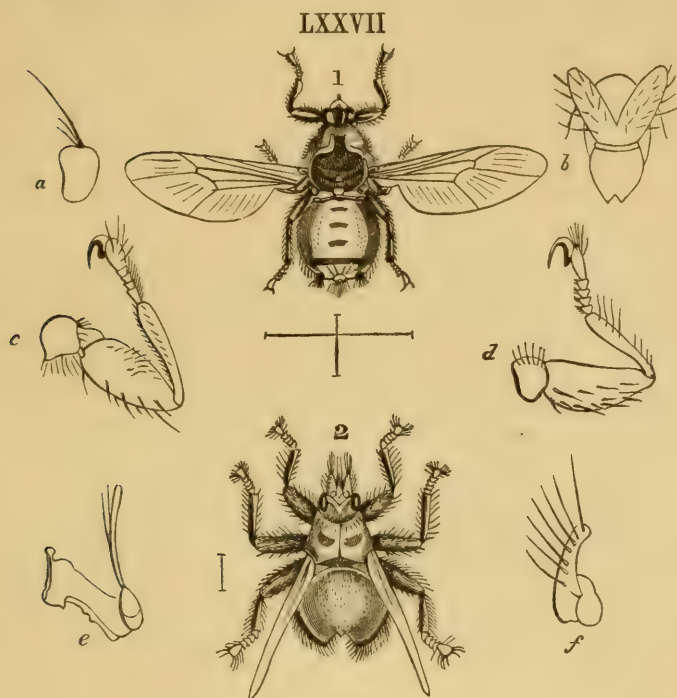
ON Woodcut LXXVI. Fig. 2 is given a figure of the FINCH FLY (*Ornithomyia fringillaria*).

On the right hand of the Fly, and at Fig. *d*, is drawn the under part of the head, so as to show the horny projections which have already been mentioned in the description of the Sheep-tick. Mr. Kirby remarks that he has himself suffered from the attacks of one of the *Ornithomyiæ*, which would persist in alighting on his head, and driving their beaks into his skin. He succeeded in catching two specimens, and found them to be *Ornithomyia avicularia*.

The colour of our present species is ochreous, changing in some lights to green. The head and thorax are shining yellow mottled with brown, and having a faint line down the middle of the back. The abdomen is dull green and hairy, the legs are bright green, and the claws jet black. The wings are iridescent and smoky. This is the smallest species of its genus, and it is found on various small birds, such as the tit-mouse, the yellow-hammer, and the robin.

ON Woodcut LXXVII. Fig. 1 is shown the insect which has been accepted as the type of its family. This is the too familiar HORSE-FLY (*Hippobosca equina*).

This very plentiful and very unpleasant insect is an absolute pest to those who have to deal with spirited horses, especially when passing through woods. The Flies settle in numbers on



1. *Hippobosca equina*. 2. *Stenopteryx hirundinis*. a. *Hippobosca equina*, antenna.
 b. Do., maxilla. c. Do., fore-leg. d. *Stenopteryx hirundinis*, fore-leg. e. Do., lip and
 tongue. f. Do., antenna.

the animal, and cling so tightly with their hooked claws that they cannot be shaken off by any efforts of the aggrieved quadruped. They cluster round its eyes, get behind its ears, under the belly, and, if they can, creep under the tail. All the angry lashings of that organ do not in the least affect their flat and tough bodies, and the repeated pricks of their sharp beaks sometimes irritate a sensitive horse to such a degree that it runs away, in the vain hope of escaping its persecutors.

The life history of this insect is very remarkable.

Fortunately for horses, the Horse Fly is anything but prolific, producing its young in a mode which is, I believe, confined to insects of this group. The mother Horse Fly never lays more than one egg, but then that egg is a phenomenon. In truth, it ought not to be called an egg, having no more right to that title than the so-called 'ants' eggs' which have already been described. The reader may remember that the eggs of certain Flies are hatched in the body of the parent, so that they are deposited in the larval and not the egg state. The Hippobosca goes a step further. The egg, as it appears to be, is no egg at all, but the skin of the larva, within which the pupa is formed, so that the young Hippobosca is already a pupa when it enters the world.

When first produced, the puparium (to use the scientific term) is white; but it soon darkens, and becomes quite hard and tough. If it be opened carefully, within it may be found the pupa, an odd-looking, crab-like being, with the legs tightly folded over the body. When the time comes for the assumption of the perfect state, it throws off the pupal skin, which it leaves within the puparium, pushes off the end of the case in which it had resided, and emerges as a perfect insect.

The chief points in the external anatomy of this insect are given on the same Woodcut. Fig. *a* represents one of the antennæ separated from the head. Fig. *b* is the part of the mouth containing the diverging horns which have already been mentioned, and Fig. *c* represents one of the fore-legs, with its very powerful thigh, and its black, incurved claws.

At Fig. 2 of the same Woodcut is seen the SWALLOW FLY (*Stenopteryx hirundinis*), so called because it is found almost exclusively on the swallow tribe. The generic name is formed from two Greek words signifying 'narrow-winged,' and is very appropriate, as may be seen by reference to the illustration.

Mr. Kirby mentions that this Fly sometimes attacks human beings:—'One found its way into the bed of the Rev. R. Sheppard, where it first, for several nights, sorely annoyed a friend of his, and afterwards himself, without their suspecting the culprit. After a close search, however, it was discovered, in the form of this Fly, which, forsaking the nest of the

swallow, had by some chance taken its station between the sheets, and thus glutted itself with the blood of man.'

Mr. Sheppard remarks, as a reason for this dereliction of their appropriate food, that no sooner does life depart from the bird than these Flies infest, than they immediately desert it and take flight, alighting upon the first living creature that they meet with; which, if it be not a bird, they soon quit, but, as it should seem from the above facts, not until they have made a trial how it will suit them as food.'

The fore-leg of this insect is shown at Fig. *d*, the lip and tongue at *e*, and the antenna at *f*. These organs should be compared with those of the previously described insects, as by their means identification becomes easy.

THE generic name of the insect represented on Woodcut LXXVIII. Fig. 1 is formed from two Greek words, signifying 'blood-devourer,' and is very appropriate. Its scientific name is *Hæmobora pallipes*. I believe it is not common enough to have any popular name.

The general colour of this insect is shining greenish-yellow, clouded with brown. The eyes and claws are black. Beneath, the thorax is boldly punctured, and covered with short and strong hairs. The wings are nearly transparent, with yellow nervures, and slightly ciliated on the costal margin. The insect is found in the New Forest, attacking indiscriminately any kind of quadruped.

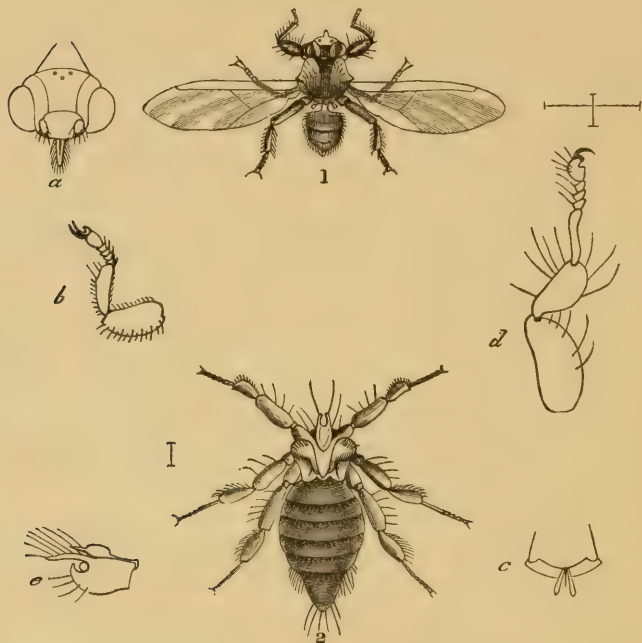
The points in which this insect differs from those which have hitherto been described are shown in the illustration. Fig. *a* gives the front view of its head, which, as will at once be seen, is very different from that of the other Hippoboscidæ. The wings, too, are very much larger in proportion, and have a few ver distinct nervures. The antenna is feathered, and the fore-leg, as shown at *b*, is short and strong. The peculiar form of the mentum, with its array of bristles, is shown at *c*.

THE second family of this group, or Nycteribiidæ, has the head very small and set on the back or upper part of the thorax, and it cannot be bent down into a cavity of the under surface of the thorax, as is the case with the preceding insect. They are without wings, but Mr. Westwood thinks that a pair

of curious little organs, like semi-circular combs, which are at the base of the intermediate legs, are the representatives of wings. The thorax is flat, and seems to be made almost entirely of the first joints of the legs, which are very long in proportion to the size of the body.

There is a peculiarity in the legs of these insects which is worthy of notice. The basal joint of the tarsus, instead of

LXXVIII

1. *Haemobora pallipes*.2. *Nycteribia Latreilli*.*a.* *Haemobora*, front view.*b.* Do., leg.*c.* Do., mentum.*d.* *Nycteribia*, leg.*e.* Do., head, side view.

being small and short, as is usually the case, is very long, and in fact, though not so thick, is quite as long as the tibia itself. Indeed, were it separated from the rest of the limb, it would be certainly mistaken for the tibia. The claws, too, are so large that they remind the observer of the sting of the scorpion. One of the legs is shown at Fig. *d* of Woodcut LXXVIII.

On Woodcut LXXVIII. is shown the insect popularly called the BAT-LOUSE, because it is never found except on the bat. The

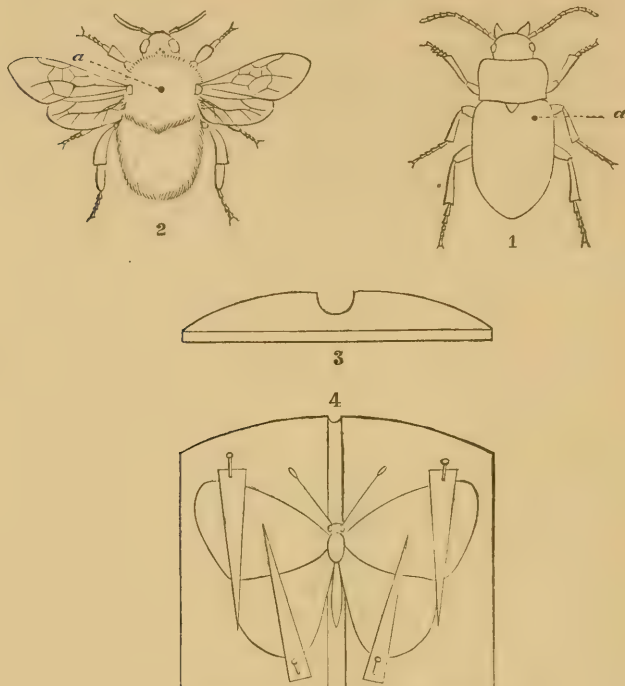
name, though, is quite as inappropriate as that of the Wood-Louse, both words signifying creatures which belong to different classes in the animal kingdom. Its colour is ochreous and shining. The hinder part of the thorax is deeply waved, and it is punctured beneath, with a channel down the centre. The abdomen is ochreous brown, and the legs are covered with hair, the tibiæ being very broad and flat. It is plentiful on the common Bat (*Vespertilio murinus*), so that there is no difficulty in procuring this curious insect. If a bat be killed, and taken into the hand, the Nycteribiæ immediately crawl from beneath the hairs of the dead animal, and crowd upon the hand of the holder. As long as the animal is alive they remain upon it, but no sooner is the life extinct than the Nycteribiæ desert it, and fasten upon the first living being that they can find, just as has been related of the Bird Flies. In some mysterious manner they know at once that the life, which constitutes their home, has fled, and they at once desert the empty tenement.

OUR task is now ended, and all that remains is to see how to prepare—or ‘set,’ as is the technical term—insects which are taken as specimens for the cabinet. On Fig. 1 of the accompanying illustration, the little black dot shows the spot at which the pin ought to be inserted in all Beetles that are more than a quarter of an inch in length. Even those of smaller size can be thus treated, provided that the entomologist use one of the fine pins which are employed for this special purpose, and can be obtained at any of the naturalists’ shops.

The best pins are gilt, so as to prevent them from producing that abominable green verdigris which is almost invariably to be found springing from the spot where the pin pierces the insect, and which so often covers and spoils the insect itself. Beetles of smaller size should be set on little strips of white card-board, some transparent cement being used for the purpose. In this case, one specimen at least should be set on its back, so as to show the under side, on which the entomologist often finds the principal distinguishing characteristics. The same rule applies to Earwigs, Grasshoppers, and their kin. It is always as well to set one specimen with spread wings, when those organs are present.

Fig. 2 shows the place of the pin in Butterflies, Moths, Bees, Flies, Dragon-flies, and their kin, and indeed in all insects where the wings are spread. Fig. 4 shows the manner in which the card braces are used for the purpose of fixing the wings, and Fig. 3 shows a section of the 'setting-board,' the upper part being made of cork.

LXXIX



SETTING INSECTS FOR THE CABINET.

Such a board, however, is rather a luxury than a necessity. Cutting a groove in cork is a very difficult business, and can scarcely be done by any except a professional cork-cutter, whose instruments are specially made for the purpose, are as keen-edged as razors, and are sharpened after every cut that is made with them. I have found, for my part, that it is quite sufficient to fasten two strips of cork side by side on a piece of soft wood, leaving between them a space just sufficient for the body of the insect.

While the process of drying is going on—a process that takes from one to five weeks, according to the size of the insect—the boards must be protected from dust and the attacks of other insects. I have always employed a ‘setting-box,’ which can be made by any lad with the least notion of carpentering. Take any conveniently sized box, with a closely fitting lid, cut a large square piece out of the lid, another out of the bottom of the box, and supply their place with wire gauze. Turn the box on its side, so that the lid opens like a door, and nail strips of wood on either end, so that a number of setting boards can be placed on them, like shelves in a book-case. Leave two inches clear space between the boards. Such a box is particularly useful, as it can be shifted from place to place at the will of the owner, and can be arranged in any spot where there is a draught of dry air.

Care must be taken not to dry insects too rapidly, as the wings generally warp and the body shrinks. Provided that a current of dry air be kept up, the process of drying cannot be too long, and above all things the young entomologist should avoid the fire. It is very tempting to dry an insect by the aid of the fire in half the time that would be occupied by the ordinary process, but such temptations must be strenuously resisted if the collector wishes to have specimens worthy of his cabinet.

If an insect be badly set, it can easily be relaxed by a very simple process. Bury in the ground a good sized flower-pot, and get a flat stone that will perfectly cover it. Pin the insect on a piece of cork, put it into the flower-pot, cover it over completely, and in two or three days the wings and legs will be relaxed, and can be reset as easily as if the creature were recently killed. In the British Museum there is a neat contrivance on the same principle. In shallow earthen vessels with tightly fitting covers a layer of sand is placed. The sand is kept damp, and when insects have to be relaxed, they are simply placed in the pan, which is then covered and put aside until the dried limbs are sufficiently moistened.

I am often asked to give hints as to the proper construction of a cabinet, and my reply is, that, unless the entomologist has plenty of money, he had better not have a cabinet at all. A good cabinet is a very expensive affair, and to procure one

cheaply is out of the question. A guinea per drawer is the invariable price of a cabinet, and it is impossible to buy one for less than that sum. Now, as the British Beetles alone will occupy from twenty-five to thirty drawers, and the British Moths at least the same number, it is evident that if the collector desires to put up all his insects in cabinets, he will not see much change out of a hundred pounds.

It is useless even to look out for second-hand cabinets, for they cost quite as much as if they were new; and, indeed, any practical entomologist would much rather buy an old cabinet than a new one, because he would be sure that no part of it would warp. There are very few joiners who know how to make an entomological cabinet, and of these few it is almost impossible to find one who will not use unseasoned wood in those places where he thinks it will not be seen.

I strongly recommend the young entomologist not to trouble himself about cabinets, but to purchase some ordinary entomologic boxes, the cost of which is comparatively trifling, and which are just as efficacious as cabinets in the preservation of insects. It is as well to label them on the back, so that a glance will tell the owner which box he will need, when he comes to put another insect in it. The two first boxes in my own collection are thus labelled:—

COLEOPTERA

1.

CICINDELA . . . AMARA.

COLEOPTERA

2.

AMARA . . . HYGROTUS.

The best mode of arranging the insects in the drawers or boxes appears to a novice to be a waste of time and space, and to be considerably disheartening to boot. Complete lists, which can be purchased at the professional naturalists, should be obtained, cut up, and pinned or otherwise fastened to the floor of the boxes in regular rows, a space being left between the names for the insertion of the insects when they are obtained. Of course, the spaces needed will depend very much on the size of the insect, and the best plan is to leave room for four rows of insects, two or three abreast, according to their size. At first, the number of blanks is quite appalling, but after a while the eye becomes familiarised to them, and then each

blank becomes a sort of challenge, calling upon the collector to fill it up. Thus, a perpetual interest is taken in the collection, and the proprietor regards it with increasing pride, as year by year the blanks become filled up, and their places are taken by row upon row of well-set insects.

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